DOS

Level 1

CompuSkills

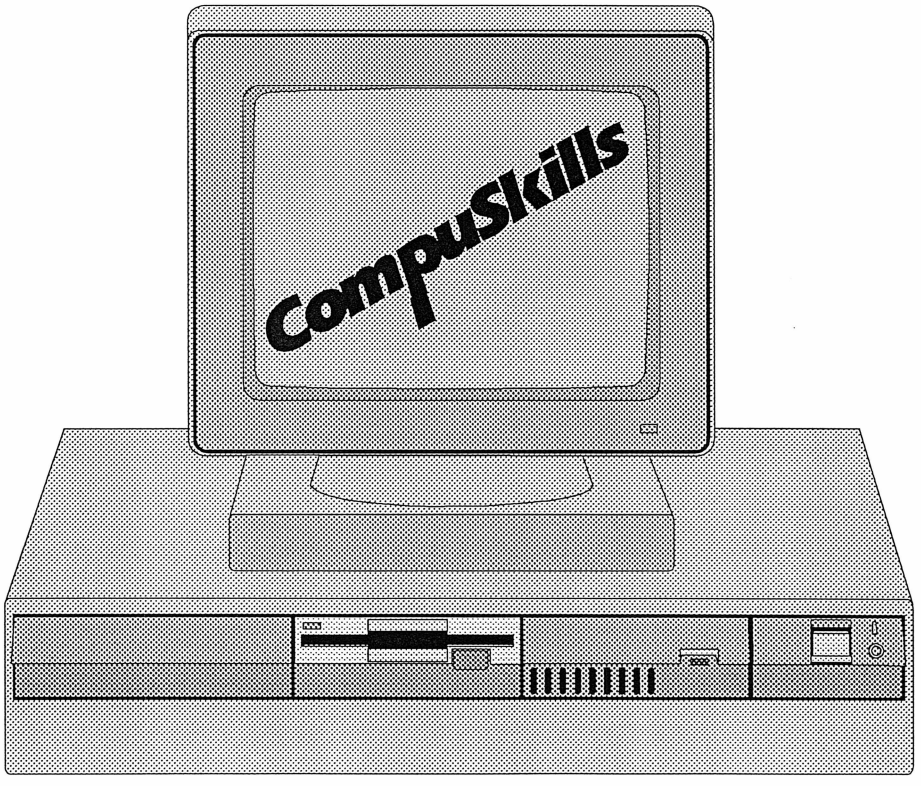
The Fast Track to Computer Literacy

An Affiliate of Colorado Free University

PO Box 6326, Denver CO 80206 (303) 329-6666

DOS

Level 1



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DOS, Level 1

Purpose: To lay a solid foundation of the operating system for the IBM-compatible PC prior to going on to DOS-based and Windows-based applications.

1. **Review of Computer Hardware**
   Microprocessors and their interaction with DOS.

2. **Components of the Processor**
   A review of how RAM, the microprocessor, the hard disk and the floppy disk drive all work together for the user.

3. **What is DOS?**
   What DOS is and why we need to know about it.

4. **Computer-Oriented Commands**
   Commands needed to set the computer up such as DATE and TIME. How to determine which is the active drive and how to move and activate other drives.

5. **What are Files?**
   What files are and the different type of files.

6. **File Names**
   The do's and don't of file names, and tips for file naming techniques.

7. **File-Oriented Commands**
   Commands that relate to files such as CREATE, RENAME, DELETE and COPY. Using * and ? wildcard characters to create more powerful commands that save time and increase accuracy. The pitfalls of using wildcard characters.

8. **Disk-Oriented Commands**
   Directory structures for both hard and floppy disks. Using switches to modify DOS commands. How to make full disk copies and comparisons. How to format disks. Using CHKDSK to check the disk capacity and integrity, and to fix lost allocation units.

9. **HELP**
   Using DOS on-line help to determine syntax and switches for all DOS commands.

10. **Directories and Directory-Oriented Commands**
    How DOS organizes files on the hard drive. Commands to move navigate these directories, to create and remove directories, and to determine the structure of the current drive.

11. **Path**
    What PATH is and why it's important to the proper operation of DOS.

See over for the contents of Levels 2 and 3. We hope to see you there!

DOS, Level 2

Purpose: Master the more advanced commands of DOS.

1. **Disk-Oriented Commands:** Review of Level 1's file and directory commands.

2. **Directories and Directory-Oriented Commands:** Review of how DOS manages files on hard drives. Commands to navigate directories, create and remove directories, and determine the structure of the current drive.

3. **Controlling DOS:** What AUTOEXEC.BAT and CONFIG.SYS do to and for your computer, and how to edit them. Multiple system configurations.

4. **Advanced DOS Commands:** Using advanced DOS commands such as XCOPY, BACKUP, RESTORE, ATTRIB, and DOSKEY.

5. **Batch Files:** Creation, troubleshooting, and running DOS commands batch files. Making batch files user friendly and interactive. Using IF and GOTO commands.

6. **Redirect, Find and Pipes:** How to redirect DOS output to files and printers. Using FIND to search files for text strings. How to join DOS commands using the PIPE.feature.

7. **Tips and Tricks:** How keyboard function keys and DOSKEY can save time in keystrokes and avoid mistakes.

8. **DOS Macros:** How to create DOS macros easily and quickly, and store them for future use.

9. **System Optimization:** Speeding systems up by improving hard disk efficiency, using disk compacting methods, and performing regular disk maintenance.

DOS, Level 3

Purpose: To equip you be a DOS expert, and to be your own troubleshooter for both hardware and DOS.

1. **The Troubleshooter's Technique:** The troubleshooting approach, and how to develop a troubleshooter's "sixth sense."

2. **POST and POST Problems:** What happens during boot up self-diagnostics, how to interpret diagnostic information, and how to change your system's CMOS settings.

3. **DOS Boot Problems:** What "booting" is, the three ways to invoke a "boot," and how to ensure that it runs properly.

4. **CONFIG.SYS Problems:** The statements in the CONFIG.SYS file, and how to determine their validity and correct order.

5. **AUTOEXEC.BAT Problems:** The commands in the AUTOEXEC.BAT file, and how to determine their validity. How to streamline routine commands and set up the file to execute programs automatically while booting your computer.

6. **Memory Resident Programs (TSRs):** What TSRs are, the problems they can cause

7. **Serial and Parallel Ports:** The different types of ports, their names, and uses. What can go wrong, and how to resolve problems.

8. **Floppy Disks and Hard Drives:** Common disk problems such as inability to boot, bad sectors, damaged FATs. How to fix problems, and the tools available.

plus Viruses, System Optimization, and Memory Management.

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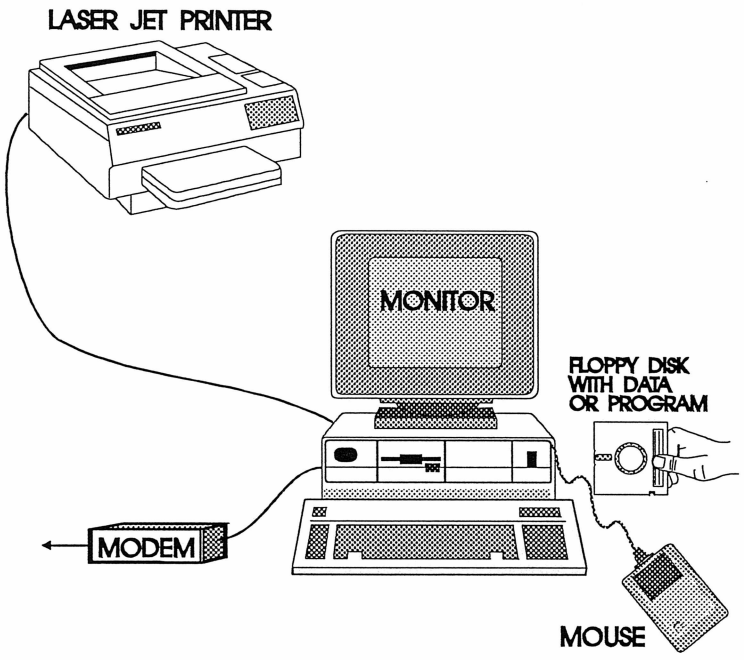
Section 1: Computer Hardware

Section 2: DOS Commands

Section 3: Directories and DOS

Glossary

Section 1: Computer Hardware



Microprocessor

The heart of the computer is a tiny black box called a **microprocessor** or **central processing unit** (CPU for short). This tiny electronic brain consists of millions of tiny circuits that execute the program's instructions and perform all the functions we have talked about. Everything else in the computer exists to serve the microprocessor. The keyboard, mouse, and disk drives exist to feed data to it, the monitor and printer exist to record what it's doing, internal memory exists to remember what's it's doing, and programs exist to tell it what to do.

Types of microprocessor

They are grouped into families known by numbers. In 1981, IBM entered the personal computer market with the IBM PC, based on a microchip made by Intel called the 8088. IBM set the standard for internal design (which other companies copied to give us **clones**) and hence all machines based on this family of chips are called **IBM-compatible**. IBM soon followed with the PC/XT (for **E**xtended **T**echnology), and then with the PC/AT (for **A**dvanced **T**echnology) in 1984, using an 80286 chip.

Components of the Processor

The processor consists of four main parts:

- **Random Access Memory** for holding the program currently being executed
- **Microprocessor** for executing the program to manipulate data
- **Hard Disk** for holding permanent copies of programs and data
- **Floppy Disk Drive** for getting programs and data in and out of the computer

The steps in executing a program are:

1. New program is installed from one or more floppy disks
2. Installed program is loaded (copied) into memory
3. Loaded program drives the microprocessor via its instructions
4. User creates data in memory by interacting with the computer via the keyboard and mouse. (Data is transient and at risk)
5. User saves data permanently on hard disk or floppy disk

What Really Makes A Computer Go?

Operating Systems

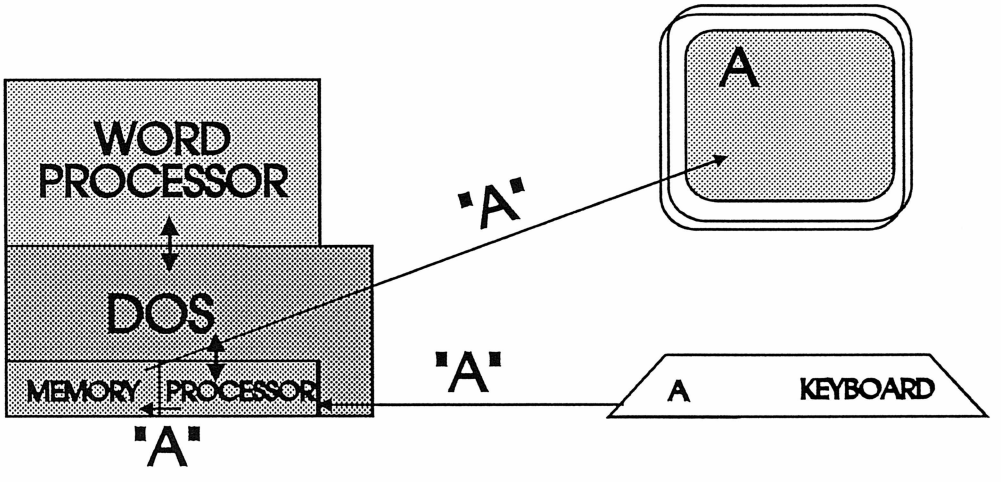
We can't talk about **hardware** without talking about a special piece of software, or program. Data must be moved between the microprocessor and the outside world of memory, disks, keyboards, monitors, mice, and so on. When the processor needs data, such as a word processing document, it must execute this special program to get the file from a disk. Or when you have finished your document, the processor must execute the special program to send your document to the printer.

This special program is called an **operating system**, and is very different from user programs like word processing, spreadsheet, and data base programs. The operating system is different because you must have one, regardless of how you use your computer.

DOS

The operating system that IBM-compatibles use is called **Disk Operating System** (DOS) because its real job is to manage data on disks, and move data between disks and internal memory. When IBM came out with the first PC, they asked Microsoft to develop this special software, and ever since then, most IBM-compatible computers use Microsoft's DOS.

DOS sits between **application programs** (like word processors) and the **hardware**, and it is the way that they use the hardware. When you type a letter on your keyboard, the word processing program asks DOS to get the microprocessor to display the letter "A" on the screen.



Compatibility

The clever thing about DOS is that versions of DOS written for different microprocessor families look the same from the outside. So you can buy a copy of a word processor like WordPerfect and it will run on an 80386 or a 68000 machine because DOS makes the adjustments.

We use **DOS commands** to control DOS, and once you have learnt the commands, you can work with any type of DOS because DOS translates your command into the specific instructions for your type of computer.

Internal Memory

The microprocessor works very quickly—faster than you can type, and faster than data can be read from or written to a disk. So, the processor needs somewhere to store its data while it's working. Also, we need somewhere to store the programs we want the computer to perform. So, the program and data you are working with at any time is held in **internal memory**. When DOS copies a program from permanent disk storage to the internal memory, we say that it's **loaded into memory**. DOS is no exception and is loaded from a disk into memory just like any other program.

RAM

The microprocessor must be able to get to any piece of data in this memory very quickly, and in any order. That is, it must provide **random access memory** (or RAM). Think of memory like an array of pigeon-holes that can hold DOS, programs, and data.

DOS	DOS	DOS	DOS	DOS	DOS	DOS
DOS	DOS	Driver	Driver	Driver	Program	Program
Program	Program	Program	Program	Program	Program	Program
Program	Program	Program	Program	Data	Data	Data
Data	Data	Data	Data	Data	Data	Data
Data	Data	Data	Data	Data	Data	

The 640 KB limit

We measure RAM in bytes, usually in thousands or millions, called kilobytes and megabytes, respectively. The size of memory limits the size of programs you can run, and the size of files you can work with. Until the late 80's, most machines had only 640 KB of RAM because that was all DOS could manage. This creates two problems:

- The size of programs you could run is limited, which means that they can't be very complicated. Because many modern programs just won't fit into RAM, a way was found to keep only the part currently being executed in memory. The rest is kept on a disk and swapped into memory when needed. This is very slow.
- If the data file you were working on is large, DOS has to swap data to and from disk, which also takes valuable time and slows the computer down.

You can buy additional memory chips for your computer to augment the 640 KB. This can be of two types: **expanded memory** or **extended memory**. But until DOS 5.0 was released in 1991, you had to buy a special program to manage the additional memory. DOS 5.0 comes with a **memory manager**, and now up to 8 MB of RAM is common.

Bigger Is Better

Now that the 640 KB barrier has been smashed, we'll see many more programs that require much more memory as they get more and more ambitious and complex. Newer versions of graphics packages allow you to create more complex artwork, in thousands of different colors. But these can take up several megabytes of storage. If you want to use these programs to the fullest extent, you'll need to increase the RAM in your computer. But don't worry—each additional 1 MB of RAM costs only about $50. (In 1984, that same RAM cost about $1500.) Aim for at least 1 MB of RAM, 4 MB if you intend to do graphics, desktop publishing or use WINDOWS, and go for 8 MB if you can. (You can buy RAM in modules of 256 KB or 1 MB called SIMMs)

Permanent Storage

While the computer is switched on, the microprocessor and RAM are the important parts of the computer, but we must have permanent storage for things we want to save between machine sessions, for data we want to move to another machine, and for a permenant record. The main form of permanent storage is the **magnetic disk**. We measure the capacity of disks in the same way as RAM—in **bytes**.

Just like audio or video tapes (but not like a CD), we can write over what's on a disk. If we don't want the data on a disk any more, we simply tell DOS to erase one or more files, or the entire disk, so that we can write new data on to it.

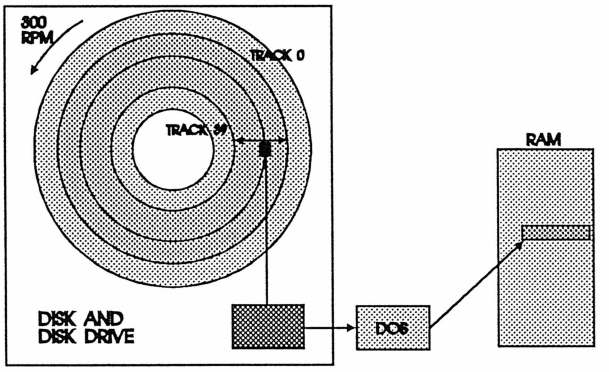
Types of Disk

We use two types of disk:

- Removable or **floppy disks** that we insert into a special read/write device (a bit like putting a cassette into a VCR)
- Fixed, or **hard disks** that stay inside the machine. These contain much more data than a floppy, and are much faster at writing and reading (recording and playback)

Floppy Disks

Floppy disks are flexible circles of the same material as audio and video tape (mylar coated with magnetic material). Data is stored in 40 to 80 concentric rings, called **tracks**. When a disk is put into a **drive**, a motor rotates it at about 300 rpm and a **read/write head** moves across the surface. DOS controls how data is read from the disk to memory, or written from memory to the disk. DOS is responsible for knowing where on the disk and where in memory to find and place data.



Formatting

When you take a new floppy disk out of the box, it is completely blank and unusable. We must use DOS to lay out the concentric tracks, and partition them into **sectors**. We call this process **formatting**, and until we do this, DOS cannot write to the disk. (Think of formatting as putting lines on a blank sheet of paper to help you write in straight lines.)

If you are sure that you no longer want the files on a disk, you can erase them one by one, or all at once. Another trick is to reformat the disk. This effectively wipes the disk clean, ready to be reused. (But be **very careful** not to reformat your hard disk by mistake.

Disk Density

As the technology for making **floppy disks** and disk drives improves, we can store more and more data on each track, and get more tracks on a disk. We used to be limited to 360 KB per disk, but now 1.2 MB and 1.44 MB (four times as much) are standard.

Disk Size

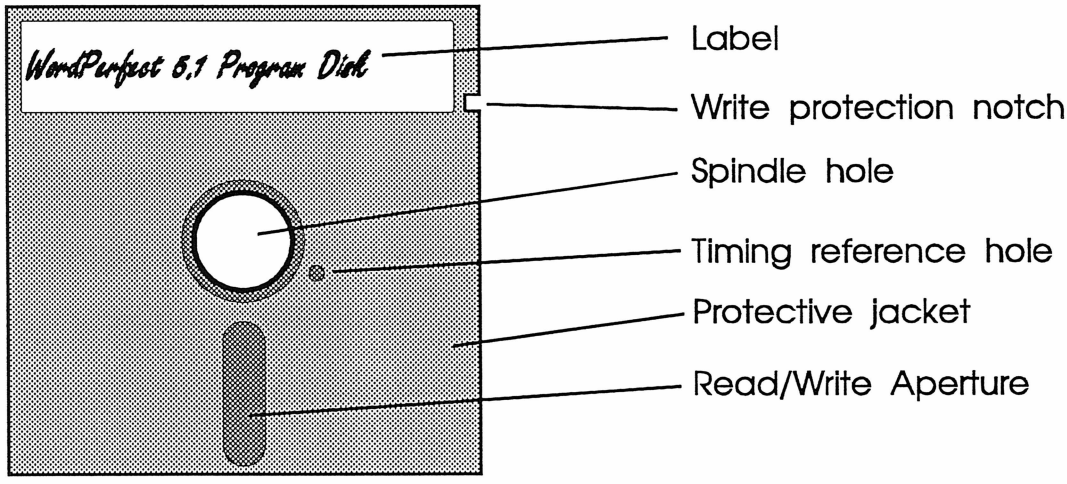
Some early floppy disks were 8 inches across, and then the industry standardized on 5¼ inches. Later, we developed a smaller disk—the 3½ inch disk which quickly caught on. Today, most software is offered on both sizes, so look on the box to make sure that the size of the disks inside matches your drive.

5¼" Disks

The most common form of this disk size used to be **double-sided, double density** (or DS/DD for short). Data is stored on both sides and the disk holds 360 KB. In 1984, IBM came out with the **high density** disk drive and disk (HD) that holds 1.2 MB. This has become the standard for 5¼" disks.

A high density (HD) drive can write to and read from a DD disk, but a DD drive cannot read a HD disk. Because the difference lies only in the way the tracks are arranged, you can put a DD disk in a HD drive and format it as a HD disk **BUT DO NOT!** The tracks on a HD disk are much closer together and require a much better magnetic coating than the lower density DD disks have. If you format a DD disk as a HD disk, it is almost certain that you will lose some or all the data within a few months.

Floppy disks are enclosed in a protective jacket with a central hole for the drive spindle, a small hole for timing purposes, and a larger aperture for the read/write head to move across the tracks. The disk is very vulnerable at this point, so be very careful not to touch the magnetic surface.



Write Protection

If you remove the plastic tags on audio and video cassettes, you can't record on them and overlay the previous recording. This valuable safeguard has been carried into the disk world. Disks have a notch on the right edge, and if this notch is open, you can change data and write over it with new data. But if you place a piece of tape over the notch, you **write-protect** it. If you try to write to the disk, DOS will tell you that you can't. Simply remove the tape and you can write to the disk again.

Using Floppies

Inserting the disk:

1. Push the disk into the drive label up, window first, until you feel resistance
2. Turn the knob or push the door shut.

Removing the disk:

1. Wait until the light has gone out
2. Turn the knob or push the door in
3. Grasp the disk and withdraw

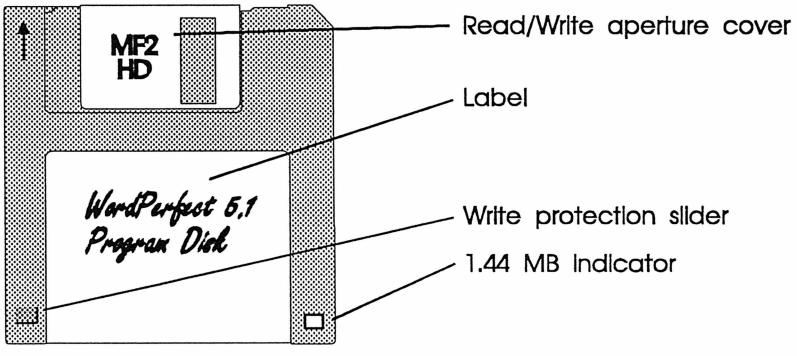
3½" Disks

The principle of a rotating disk is still the same, but the 3½" disk is a significant advance over the 5¼" because it's smaller, sturdier, and can be mailed more safely.

The main differences are that:

- The read/write aperture is protected by a spring-loaded metal slide
- The write protect slot uses a plastic sliding square. If the hole is open, the disk is protected, and if the hole is closed, it's not protected. (This is analogous to the cassette where you can't record if the plastic tab is missing.)

3½" disks and disk drives come in two capacities: 720 KB and 1.44 MB, but the industry has standardized on 1.44 MB.



Using Floppies

Inserting the disk

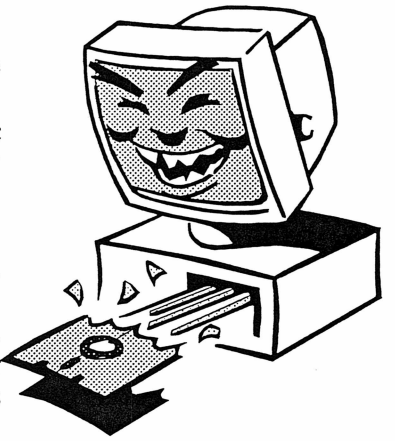
1. Push the disk into the drive label up, window first until you feel resistance

Removing the disk

1. Wait until the light has gone out
2. Push the knob to eject the disk

Disk Safety

1. Do not write on 5¼" disk jackets with a pencil or ball-point pen. This could score the disk inside. Instead, use a felt tip pen or prepare the label before sticking it on the disk jacket
2. Keep 5¼" disks in the paper envelope to keep dust out and fingers away from the disk itself. Keep 3½" disks in a plastic bag to keep dust out
3. Do not bend a 5¼" disk
4. Do not subject disks to extremes of temperature, high or low. Do not leave them in your car.
5. Do not expose disks to magnetic fields or magnets. Try to be aware of the magnets in your house or office, like loudspeakers, and the magnetic fields around appliances.
6. Be aware of the value of your data.



Write Protection

Write protect all important disks, like program disks you buy and disks containing valuable files. Write protection is valuable if you're copying a lot of files between disks and might get confused about source and target disks. You could inadvertently copy a new blank disk on to your full data disk and wipe everything out. So write protect your data disks before doing this or lending your disks to someone else. Not everyone is as careful as you.

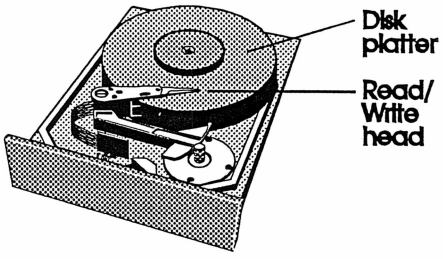
How Many Floppy Drives?

Of course, every machine must have at least one floppy drive, because that's how you load the programs you buy, back up your hard disk, and transfer data to another machine. Since no one buys a machine today without a hard disk, one floppy drive may be enough. Most vendors provide their software on both types of disk, but not all. If the software you'll use is available on 3½" disks, opt for that size, otherwise go for 5¼".

However, if you work with both the 5¼ and 3½ inch sizes, you'll need both types of drive in your machine. At about $50 each, the flexibility is worth it.

Hard Disks

Floppy disks are convenient ways of storing data outside the computer but they are slow and limited in capacity. **Hard disks** work basically the same way, but they are non-removable, hermetically sealed, rotate much faster (3,600 rpm), are protected from vibration, and much better engineered. As a result, they can hold much more data (200 MB is common), and read and write data much faster than floppy drives. The 1991 price for a 200 MB hard disk is about $700. That's about $3.50 per MB compared with about $50 per MB for a floppy drive and disks. And as with everything in the PC industry, capacities are going up and prices are coming down.



But...

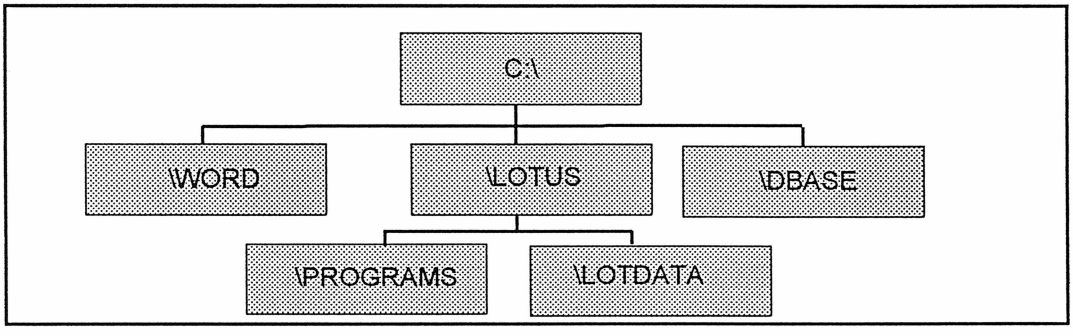
With a hard disk, you can store thousands of files:

- Data you create
- Programs you buy
- Operating system and utilities.

But, it's very easy to lose a file in all that mess, just like you could lose a document you filed randomly in an entire room full of filing cabinets. No office manager would allow files to be dumped into the filing cabinets with no indexing or partitioning, and neither should we.

Directories

When DOS formats a hard disk (and it should only happen once!), it creates what we call a **root directory** which is like a master index. We then create **subdirectories** for the various partitions of our work (like word processing, spreadsheets, graphics) below the root directory, and store the data and programs in the appropriate directory. This means that we must become our own office manager, and devise a scheme for structuring our data. We'll return to this subject later.



Section 2: DOS Commands

What is DOS?

DOS stands for **Disk Operating System**, the standard operating system used by IBM-compatibles. First introduced in 1981, DOS has undergone major enhancement. DOS 5.0, released in 1991, was a vastly more powerful and flexible product than its predecessors, and DOS 6.0, released in March 1993 provides an extremely useful collection of utilities. Microsoft released DOS 6.2 late 1993 with additional protection for disk management.

The operating system is the most important program running on a computer, because without it, the hardware is useless. It handles the outside world of keyboards, monitors, disk drives, and printers, and the internal tasks of memory management. DOS also manages data on disks, including the awesome task of tracking files and directories on hard disks.

Why do we need to know about DOS?

Until Microsoft releases a version of Windows that manages the computer directly, we still need DOS. Therefore, it's imperative that any user of a personal computer knows what DOS does, how to make it happen, and what to do when things go wrong. Today's hardware is incredibly reliable, but disks still crash, and the power still goes off during a critical disk update. That's when we really need to know about DOS and our computer.

Types of DOS Commands

We instruct DOS to perform operations by means of a command language. Types of command include:

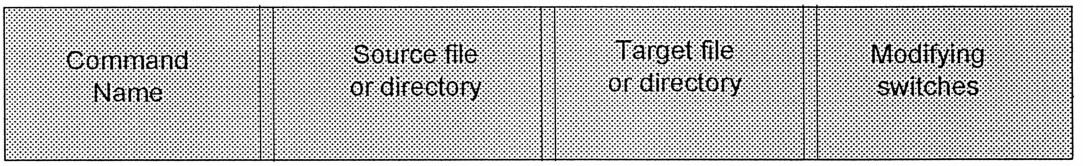
- Computer-oriented commands to tell the computer about the outside world
- File-oriented commands that work at the level of the individual file
- Disk-oriented commands to manage disks
- Directory-oriented commands to organize our files on hard disks

DOS Command Line

We tell DOS what to do by typing commands against the DOS prompt. The simplest prompt consists just of the symbol >. A blinking **cursor** after the >_ tells us that the ball's in our court, and we begin typing the command at the cursor immediately after the > symbol.

DOS commands consist of four segments:

1. The command itself, like COPY, FORMAT, ERASE
2. The source directory or filename
3. The destination directory or filename
4. Switches that modify how DOS executes our command



With many commands, segments 2, 3, and 4 are optional, but if they are included, they **must** be separated by spaces:

```
COPY  filename1  filename2 /a
```

Note that each part of the command is separated from the other parts by a space. Finally, we must press the **ENTER** key after typing a command, otherwise DOS will wait for ever.

1. Computer-oriented Commands

Date

The computer has a built in calendar. We can reset it using the DATE command:

```
C:\>DATE
```

The computer comes back with:

```
Current date is Fri 01-17-1992
Enter new date (mm-dd-yy):
```

Time

The computer also has a built in clock. We can reset it using the TIME command:

```
C:\>TIME
```

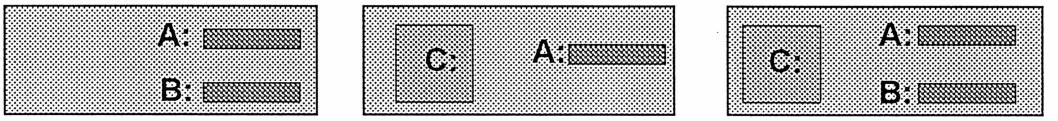
The computer comes back with:

```
Current time is 09:35:23a
Enter new time (hh:mm:ss): _
```

[DOS versions 5.0 and 6.0 use a 12-hour clock. Earlier versions used a 24-hour military style clock.]

Drive Letters

We must always know which is the active drive, in other words, whether the next command will affect one of the floppy drives or the hard disk. Each drive is given a letter followed by a colon.



The colon is a vital part of the drive identity, and DOS will not know that A means the A drive and C means the hard disk. **You must type A: or C:!** To change the current drive, simply type in A: or C: against the prompt, and DOS will switch to A: or C:

```
C:\>A:
A:\>
```

2. File-oriented Commands

Files

A **file** is a named collection of data or information. Almost all information that the computer deals with must be held in a file. There are many different types of file:

- **Text files** from word processors, like letters, reports, memos, and dissertations. These files consist of one large block of text. Word processors like WordPerfect, Word, and Multimate also allow us to build files consisting of lots of small name and address records for merging with standard letters and for printing name and address labels
- **Spreadsheet files** from spreadsheet applications like Lotus, Excel, and Quattro
- **Data base files** from applications like dBase and Paradox. Data base files consist of hundreds or thousands of individual records, each record holding specific information about one person, place, or thing.
- **Graphics line art files** from graphics programs like CorelDraw and Adobe Illustrator. Graphics line art files consist of lines, circles, other shapes, and text that make up the image, plus all the data needed to display and print the image.
- **Graphics image files** from paint programs like PC Paint and PC Paintbrush. Graphics image files consist of thousands of black dots that make up the image, plus all the data needed to display and print the image.
- **Application program files** for applications like WordPerfect, Ventura Publisher, and Lotus 1-2-3. These files contain the instructions for interpreting your input (via keyboard and mouse), displaying work-in-progress on the screen, doing all the necessary processing, and generating the required printed output
- **System program files** for system programs like DOS and Windows. These files contain the detailed instructions invoked when you issue a command like FORMAT or COPY.

File Names

Files must be named so that DOS can retrieve them later. DOS is quite picky about file names and we must follow the rules. File names have two parts:

- Filename, consisting of up to 8 characters.
- Filename extension, consisting of up 3 characters. This is optional, and you can choose any extension you like. But it's usually used to indicate the type of file, like .DOC which indicates that the file is a Word document, or .XLS for spreadsheet.

  NEVER CHANGE THE EXTENSION OF PROGRAM FILES!

If we use an extension, we must separate it from the filename by a period, like COMMAND.COM but if we do not use an extension, we leave the period out.

Neither the filename nor extension must be unique on their own, but the combination of filename and extension must be unique within a disk.

File Naming

We should use descriptive names that make full use of the 8 characters to help us remember what's in a file. For example:

Clients	CLIENTS
Clients A - N	CLNTSA-N
Clients O - Z	CLNTSO-Z
Airline schedules	AIRSCHED
Book List	BOOKLIST

File naming "do nots"

1. **No spaces**. A space means the end of a filename. Join single words by a hyphen or the underline character.
2. **Use ! @ # $ % & ( ) _ - ~ ~ "**

   but not use | * ? \ / < > because these have special meaning for DOS and it will interpret them as part of a command. We'll come back to how they're used later.
3. **Use mnemonic names**. Cryptic or general names like FL003, M.BAT, and MYFILE are meaningless.
4. Retain filename extensions. Programs look for files with certain extensions. The extensions that DOS uses include: COM, EXE, BAT, and SYS.

Get the name right

If we mistype a file name or command, DOS will reply with:

```
Bad command or file name
```

Don't worry. Just retype the command and try again.

Creating files

When we type a document in a word processor, or enter values to cells in a spreadsheet, and then want to save our work, the application asks us for a file name before it can write the file to disk.
Many application programs add extensions automatically to data files for their own use, so check the documentation. For example, Ventura Publisher uses PUB, CHP, CIF, CAP, VGR, and STY, and will only open files with these extensions.

Renaming files

If we're not happy with a file name, we can rename it with the DOS **RENAME** command:

```
RENAME drive\path\filename1 filename2
```

For example:

```
C:\>RENAME C:\WP51\DOCS\MYFILE JONESLTR
```

or we can use the short form, **REN**. Watch the spelling, and the spaces between the file-names. And do not repeat the path in the target filename.

Erasing files

When a file has outlived its usefulness, we can delete it with ERASE filename:

```
C:\>ERASE MEMO.WP
```
or
```
C:\>DEL MEMO.WP
```

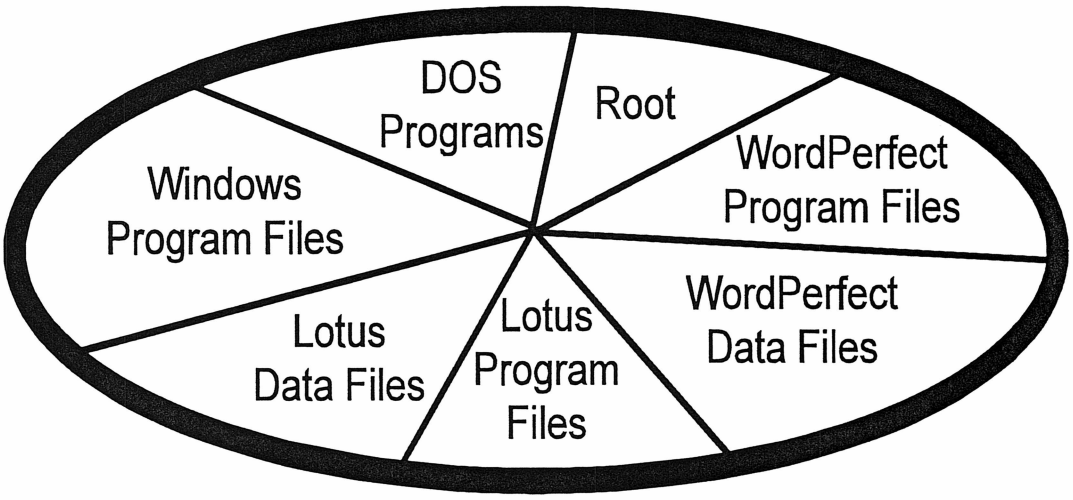
3. Directory-oriented Commands

Directories

A typical hard disk can contain thousands of files, so we need some way of organizing them so that we can find them again quickly.

DOS supports directories—logical partitions on a disk that "contain" files. When we look at disk contents, we see the directories, and can then examine the files inside them.

A typical hard disk may have many directories, each containing files relating to a particular program or type of data. Every disk also has a **ROOT directory**. On a hard disk, the root contains important files. On a floppy disk, the root is usually the only directory.



A typical hard disk has many directories, each specializing in holding a particular type of data file, e.g. DOS, WINPROBE, MM_SOUND, WINDOWS, etc.

```
 Volume in drive C is MS-DOS_5
Directory of C:\

DOS         <DIR>        12-20-93  12:45p
WINPROBE     <DIR>        12-21-93  10:46a
MM_SOUND     <DIR>        02-02-94  11:11a
WINDOWS      <DIR>        12-20-93   1:55p
MM_STUD      <DIR>        02-02-94  11:14a
NN_ENCYC     <DIR>        02-02-94   1:08p
DEV         <DIR>        12-20-93   2:39p
BIN         <DIR>        12-20-93   2:39p
PSFONTS      <DIR>        12-20-93   2:43p
WINWORD      <DIR>        12-20-93   4:41p
ACCESS       <DIR>        12-20-93   4:38p
```

Directory List

The following example, shows the "contents" of the directory called MOUSE. It holds all the files required to manage the mouse:

```
C:\>dir mouse

 Volume in drive C is MS-DOS_5
 Directory of C:\MOUSE

.           <DIR>          12-20-93   5:41p
..          <DIR>          12-20-93   5:41p
MOUSE    COM        34,295 05-17-91   4:31p
README   MW6         7,593 10-17-91  10:24a
MTUTOR   EXE        37,413 06-04-91   9:41a
MTUTOR   SCR        18,932 06-06-91   8:40a
CLICK    EXE        14,908 05-24-91   3:28p
CLICKED  EXE        51,311 05-16-91   3:42p
CLICKED  SCR        22,040 04-29-91   3:51p
GOMENU   EXE        29,437 05-01-91  11:05a
GOMENU   OVL        25,910 05-01-91  11:06a
LOGIMENU COM         8,913 04-30-91   9:20a
KEYBASE  MNU            79 05-11-90  10:57a
MOUSE    SYS        34,499 05-17-91   4:32p
      14 file(s)        285,330 bytes
                    198,770,688 bytes free
```

We examine the contents of a directory using the DIR command. Note that the DIR command shows us:

- Directory name
- File names and extensions
- File sizes in bytes
- Date and Time the file was created or last changed
- Number of files in the directory and their total size
- Number of bytes remaining on this drive

Simply follow the DIR command with the directory name you want to examine:

```
C:\>DIR MOUSE
```

There are many more directory commands that we'll use later.

Switches

If there are more files in a directory than fit on the screen, DOS scrolls them by too quickly to read. We use **switches** to slow the display down.

In DOS commands, things like /P and /W are called **switches** because they modify the command like turning a switch on. We'll come across many more types of switch later, but for now type:

```
C:\>DIR WINDOWS /P
```

lists the filenames one **page** at a time. Just hit any key to look at the next screen of filenames.

```
C:\>DIR WINDOWS /W
```

results in a **wide** listing of just file names:

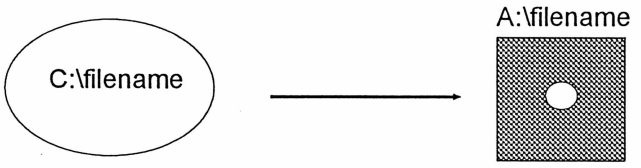
```
JAN-RPT.WP      APR-RPT.WP          SMITH.LTR
FEB-RPT.WP      MAY-RPT.WP          SMITH.WKS
MAR-RPT.WP      JUN-RPT.WP          SMITH.MEM
```

To find out more about a DOS command, what it can do, and what switches you can use, DOS provides a powerful HELP subsystem.

4. More File Commands

Copying files

Often we create a file on one machine's hard disk and want to copy it to a floppy and then copy it again on to another machine's hard disk.



To copy a file from a hard disk to a floppy disk, keeping the same name:

```
COPY c:\filename  A:\
```

For example, if we had a data base file called CLIENTS.DB on the C: drive and wanted to copy it to the floppy in the A: drive:

```
C:\>COPY  C:\CLIENTS.DB  A:\
```

copies CLIENTS.DB from the hard disk to the floppy disk in the A: drive and calls the copy CLIENTS.DB also.

Files can have the same name so long as they're on different floppies. We can't have two files called CLIENTS.DB on the same floppy.

If we typed:

```
C:\>COPY C:\CLIENTS.DB C:\CLIENTS.DB
```

DOS would tell us:

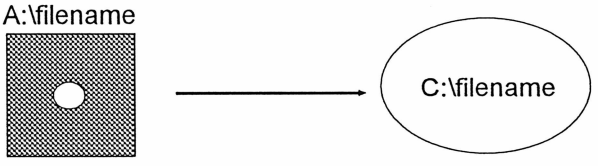
```
FILE CANNOT BE COPIED ON TO ITSELF.
```

So we would need to give the copy a different name, like CUSTOMER.DB

```
C:\>COPY A:\CLIENTS.DB A:\CUSTOMER.DB_
```

Then, to copy the file from the floppy to another computer's hard disk, we would use:

```
C:\>COPY A:\CLIENTS.DB  C:\
```



Wildcards

If we have to work on several files, all with something common in their filenames, there's a quick way of telling DOS to do this. Suppose we want to copy twelve files containing monthly reports called JAN-RPT, FEB-RPT, MAR-RPT, APR-RPT, and so on,.

We can use **wildcard characters** to stand for the variable part of the file names. They're just like wildcards in poker that can be any other card. If we tell DOS to copy all files whose names match **???-RPT**, DOS will copy the twelve monthly files, plus any others that match, such as DOG-RPT and CAT-RPT.

The **?** represents any character in the position it occupies, so we would only have to type:

```
C:\>COPY A:\???-RPT C:\
```

and DOS would copy any file with "-RPT" in positions 4-7 of the filename.

If we had called our 12 files RPT-JAN, RPT-FEB, RPT-MAR, and so on, we could use:

```
C:\>COPY A:\RPT-??? C:\
```

but we can use the * wildcard to select all files with any value in the trailing part of the name:

```
C:\>COPY A:\RPT-* C:\
```

Because * stands for **any character in this and any following position,** including no character, it will also pick up filenames like RPT-JO, RPT-1, RPT-JOHN, and RPT-. Notice that * also picks up filenames with a character in position 8. In fact, * in position 5 includes all file names that begin with RPT- regardless of what's in positions 5 - 8, e.g.:

```
RPT-, RPT-JAN, RPT-FRED, RPT-1, RPT-12.
```

We can't use the * in front of other characters. For example, the following is **not** allowed:

```
C:\>COPY A:\*-RPT C:\
```

We can also use * and ? in filename extensions, so if we had our files called RPT.JAN, RPT.FEB, RPT.MAR, and so on, we could use:

```
C:\>COPY A:\RPT.* C:\
```

We can combine wildcards in the filename and extension. The most common combination is ***.*** meaning every filename. For example, to copy all the files from A: to C:

```
C:\>COPY A:\*.* C:\
```

Disaster awaits

We can use wildcards with other DOS commands, which can be very dangerous. For example, the following means "delete every file in the WINDOWS directory" and we should be very careful when we use it:

```
C:\>ERASE WINDOWS\*.*
```

This command will do just that, i.e., erase every file in the directory. Fortunately, we would be saved by a message like:

```
All files in directory will be erased.

Are you sure (Y/N)?
```

but we don't want to run the risk of accidently hitting the Y key.

We can use the DOS **undelete** command to recover accidently deleted files if we haven't already written some other file into the space created when we deleted it. If we have already written over it, it's gone for ever. Therefore, do not delete files casually, especially using wildcards.

Look before you leap

Before using * or ? in any command, check to see which files would be selected by using the DIRECTORY (or DIR) command. So before using:

```
C:\>DEL  A:\RPT.*
```

use the following command to list the files that will be deleted, just to avoid surprises:

```
C:\>DIR  A:\RPT.*
```

which will list all the files on the floppy that have RPT as the file name. We can use the same wildcards in the DIR command to make it very specific.

5. Disk-oriented Commands

Copying disks

Often, we want to make an exact duplicate of a disk, like when we buy a new program and need to make a security copy. We use the **DISKCOPY** command. The two floppy disks must be identical types, like both double-density 5¼ inch, or both high-density 3½ inch disks.

DISKCOPY A: to B:

The simplest form of DISKCOPY is used when we have two identical disk drives. We put the **source** disk in A: and the empty **target** in B:, and type:

```
C:\>DISKCOPY A: B:
```

DOS will come back with a message like:

```
Insert SOURCE diskette in drive A:
Insert TARGET diskette in drive B:
Press any key when ready...
```

DOS will make an exact replica of the disk in A:. If the disk in B: is not formatted, DOS will format as it writes the data to B:. DOS doesn't care whether there are any files on the disk in B:. It will overwrite anything. And when it's finished, DOS will come back with:

```
Copy complete

Copy another (Y/N)?
```

and you press either the Y key to repeat the process for the next disk, or press N.

But who has two identical disk drives? The usual form of DISKCOPY uses one floppy disk drive and DOS uses internal memory to remember the disk contents while you switch them around.

DISKCOPY A: to A:

```
C:\>DISKCOPY A: A:
```

DOS replies:

```
Insert SOURCE diskette in drive A:
Press any key when ready...
```

Put the source disk in A: and press any key. DOS reads the disk's data into memory and then tells us to:

```
Insert TARGET diskette in drive A:
Press any key when ready...
```

When we do so, DOS writes the data from memory to the new disk in A:, overwriting any data on the target diskette. This may take more than one "pass" because the computer's memory cannot hold the entire contents of the floppy disk.

Disk Copy vs. File Copy

Notice that DISKCOPY is different from the COPY command. COPY works at the **file level,** and DISKCOPY works at the **disk level**:

```
C:\>COPY A:\*.* B:\
```

will copy the files, one by one, from the disk in A: to the disk in B: using up the available space on the B: disk. DOS lists the files it copies, and continues until it's finished. Then it comes back with a message like:

```
7 file(s) copied
```

But if the disk in B: is smaller than A: or already contains files, DOS runs out of space and stops copying giving the message like:

```
Insufficient disk space
5 file(s) copied
```

Formatting

Formatting prepares a blank disk to receive data, like drawing lines on blank paper to help us write in straight lines. DOS draws concentric rings (**tracks**) on the disk, and divides each track up into **sectors** of typically 512 bytes (or 2048 on hard disks).

To format a new disk, put the disk in the A: or B: drive and type:

```
C:\>FORMAT A:  (or B:)
```

DOS replies with:

```
Insert new diskette for drive A:

and press ENTER when ready...
```

Unformat

DOS (5.0 and later) includes an **UNFORMAT** command just in case we accidently format a valuable disk. So, before DOS formats the disk, it will check the disk out so that it can re-constitute the files later if we issue the UNFORMAT command. [Older versions of DOS simply warn us that any existing information will be lost and asks for permission to continue.]

DOS tells us:

```
Checking existing disk format
Saving UNFORMAT information
```

then DOS reports back:

```
Verifying 1.2M
Format complete
Volume label (11 characters, ENTER for none)?
```

and invites us to provide a name for the disk. DOS completes the operation by telling us something like:

```
1213952 bytes total disk space
15360 bytes in bad sectors
1198592 bytes available on disk

512 bytes in each allocation unit
2341 allocation units available on disk

Volume Serial Number is xxxx-xxxx

Format another (Y/N)?
```

Formatting used disks

If we have a used disk that contains files we no longer need, we could clean it up with:

```
C:\>ERASE  A:\*.* or C:\>DEL  A:\*.*
```

to delete all the files. But this may leave unused and fragmented sectors lying around. If we really want to clean it up, we can reformat it. DOS wipes everything off, and draws new tracks. There are 2 dangers here:

1. We might reformat a valuable disk by mistake.
2. By mistake, we might tell DOS to reformat our hard disk. Not a smart thing to do! So, we **must** include the A: or B: drive letter and **never** just type:

```
C:\>FORMAT
```

6. Checking Your Disks

CHKDSK

We often need to check how much data capacity is on the disk. Or we might need to see if there's enough room to copy more files on to an existing disk.

Put the disk in A: or B: and type:

```
C:\>CHKDSK A:
```

With CHKDSK, DOS will come back with something like:

```
1213952         bytes total disk space
55027           bytes in 7 user files
1158925         bytes available

512             bytes in each allocation unit
2371            total allocation units on disk
2125            available allocation units on disk

655360          total bytes memory
532336          bytes free
```

This valuable information tells us:

- The total disk capacity, how much of it is taken up with how many user files, (and possibly hidden files), and how much capacity is free
- The size of the unit of disk space that DOS allocates to holding files, how many units are on the disk, and how many are free
- Total conventional memory available to DOS and how much is free for application programs. The DOS program itself accounts for the difference between these two numbers.

SCANDISK

DOS 6 and later offer SCANDISK, a disk-repair program that:

- Checks and repairs a drive (regular or Doublespaced)
- Examines a file for fragmentation
- Undo repairs you made previously

To check and repair the current drive, type SCANDISK without parameters.

Lost Units

When we write and erase files over time, allocation units (512 byte areas) may get "lost." DOS will ask us whether we want them recovered if the CHKDSK or SCANDISK operation finds them.

If we have included the /f switch:

```
C:\>CHKDSK A: /f
```

and answer Yes to the question:

```
Convert chains of lost allocation units?
(Yes/No)
```

then DOS converts them to dummy files that it calls FILE0000.CHK, FILE0001.CHK, and so on. DOS renames the lost data in the File Allocation Table on the disk. We should check to see if these files contain any data we want to keep. If not, we can simply delete them. The space they took up on the disk is now free and available for our data files.

With SCANDISK, the optional switches are:

- ALL — Checks and repairs all local drives.
- AUTOFIX — Fixes damage without prompting.
- CHECKONLY — Checks a drive, but does not repair any damage.
- CUSTOM — Configures and runs ScanDisk according to SCANDISK.INI settings.
- NOSAVE — With /AUTOFIX, deletes lost clusters rather than saving as files.
- NOSUMMARY — With /CHECKONLY or /AUTOFIX, prevents ScanDisk from stopping at summary screens.
- SURFACE — Performs a surface scan after other checks.
- MONO — Configures ScanDisk for use with a monochrome display.

7. DOS Help

DOS **on-line help** is available from the DOS prompt, and takes two forms:

- List of DOS commands and what they do
- Details of each command's syntax and switch settings

Command List

For DOS 5 or earlier, at the DOS prompt, simply type **help**. DOS lists commands and their functions:

APPEND	Allows programs to open data files in specified directories as if they were in the current directory.
ASSIGN	Redirects requests for disk operations on one drive to a different drive.
ATTRIB	Displays or changes file attributes.
BACKUP	Backs up one or more files from one disk to another.
BREAK	Sets or clears extended CTRL+C checking.
CALL	Calls one batch program from another.
CD	Displays the name of or changes the current directory.
CHCP	Displays or sets the active code page number.
CHDIR	Displays the name of or changes the current directory.
CHKDSK	Checks a disk and displays a status report.
CLS	Clears the screen.
COMMAND	Starts a new instance of the MS-DOS command interpreter.
COMP	Compares the contents of two files or sets of files.
COPY	Copies one or more files to another location.
CTTY	Changes the terminal device used to control your system.
DATE	Displays or sets the date.
DEBUG	Runs Debug, a program testing and editing tool.
DEL	Deletes one or more files.
DIR	Displays a list of files and subdirectories in a directory.
DISKCOMP	Compares the contents of two floppy disks.
DISKCOPY	Copies the contents of one floppy disk to another.
DOSKEY	Edits command lines, recalls MS-DOS commands, and creates macros.
DOSSHELL	Starts MS-DOS Shell.
ECHO	Displays messages, or turns command echoing on or off.
EDIT	Starts MS-DOS Editor, which creates and changes ASCII files.
EDLIN	Starts Edlin, a line-oriented text editor.
EMM386	Turns on or off EMM386 expanded memory support.
ERASE	Deletes one or more files.
EXE2BIN	Converts .EXE (executable) files to binary format.
EXIT	Quits the COMMAND.COM program (command interpreter).
EXPAND	Expands one or more compressed files.
FASTOPEN	Decreases the amount of time needed to open frequently used files and directories.
FC	Compares two files or sets of files, and displays the differences between them.
FDISK	Configures a hard disk for use with MS-DOS.

Clicking on a command tells DOS to display more information about the command.

Command Help

At the DOS prompt, either type the command name with a "/?" switch:

```
commandname /?
```

or type:

```
help commandname
```

For **help chkdsk**, DOS displays:

```
CHKDSK

Checks a disk and displays a status report.

CHKDSK [drive:][[path]filename] [/F] [/V]

[drive:][path] Specifies the drive and directory to check.
filename       Specifies the file(s) to check for fragmentation.
/F             Fixes errors on the disk.
/V             Displays the full path and name of every file on the disk.

Type CHKDSK without parameters to check the current disk.
```

With DOS 6, typing **help** results in:

```
------------------ MS-DOS Help: Command Reference --------------------

Use the scroll bars to see more commands. Or, press the PAGE DOWN key.
For more information about using MS-DOS Help, choose How to Use MS-DOS
Help from the Help menu, or press F1. To exit MS-DOS Help, press ALT, F,
X.

<What's New in MS-DOS 6.2?>

<ANSI.SYS>              <Erase>              <Nlsfunc>
<Append>                <Exit>               <Numlock>
<Attrib>                <Expand>             <Path>
<Batch commands>        <Fasthelp>           <Pause>
<Break>                 <Fastopen>           <Power>
<Buffers>               <Fc>                 <POWER.EXE>
<Call>                  <Fcbs>               <Print>
<Cd>                    <Fdisk>              <Prompt>
<Chcp>                  <Files>              <Qbasic>
<Chdir>                 <Find>               <RAMDRIVE.SYS>
```

Using your mouse, click on a command to see detail about it. For each command, DOS offers:

- Notes about the command and what it does
- Command syntax
- Examples of use

Summary of File- and Disk-oriented Commands

We have seen the following file-oriented commands:

Rename	`REN filename1 filename2`
Erase	`ERASE filename` `DEL filename`
Copy	`COPY A:\filename B:\` `COPY A:\filename1 A:\filename2`

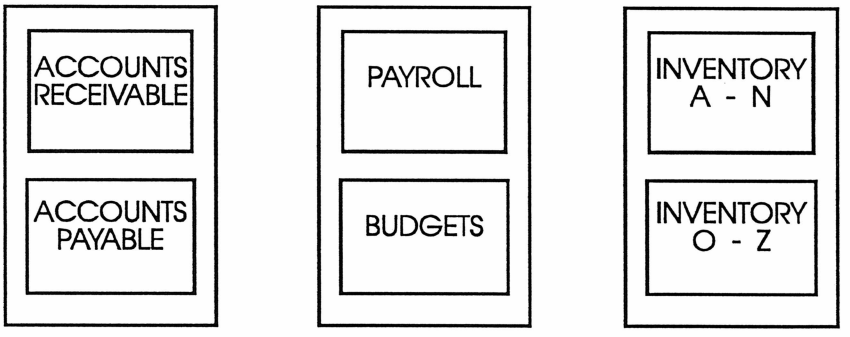
List files	`DIR A:\`
	`DIR A:\ /P`
	`DIR A:\ /W`

Diskcopy	`DISKCOPY A: A:` `DISKCOPY A: B:`
Disk compare	`DISKCOMP A: A:`
Format	`FORMAT A:`
Disk check	`CHKDSK A:`
Help	`HELP`
Command help	`command /?`

Section 3: Directories and DOS

If we had a manual filing system of thousands of folders covering many different aspects of our work, we would devise a way of organizing them, such as:

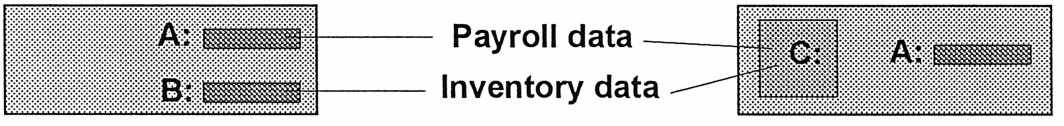
- Accounts Receivable
- Accounts Payable
- Payroll
- Budgets
- Inventory



In other words, we would partition our data for fast, easy retrieval in the future so that if we wanted the Smith's account data, we would not have to start at the first file and systematically work our way through.

When we use floppy disks, we might put only one type of file on a floppy. For example, we might have an Accounts Receivable floppy, a Payroll floppy, and so on. By doing this, we have already organized our data, and we simply put the right floppy disk in the disk drive.

When we use a hard disk, we need to get smarter and can't treat the hard disk like one large "bin" for all our files. Computers are fast, but we need to speed up our disk accesses by giving DOS some idea of where to find a file on our hard disk.



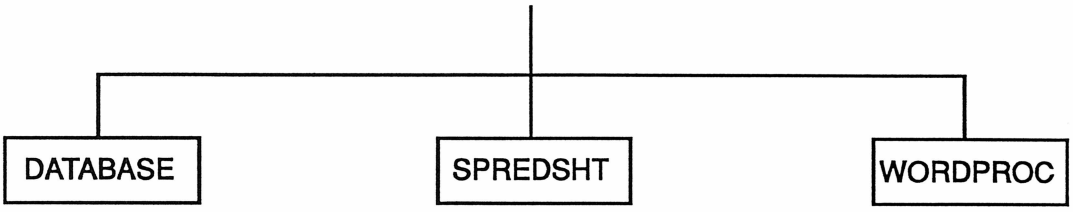
We use the idea of filing cabinets inside the hard disk to partition our data. There are countless ways we can do this. But because we can perform many types of activity on a computer, one way is to partition our data by application, such as:

- Word processing (WordPerfect, Word, Multimate, etc)
- Spreadsheets (Lotus, Excel, Quattro, etc)
- Data base (dBase, Paradox, etc)

This means that we hold all the files associated with an application together, and can easily remember where we put them. Also, we can tell the application where to put data files once only, and let it remember for us.

Directories

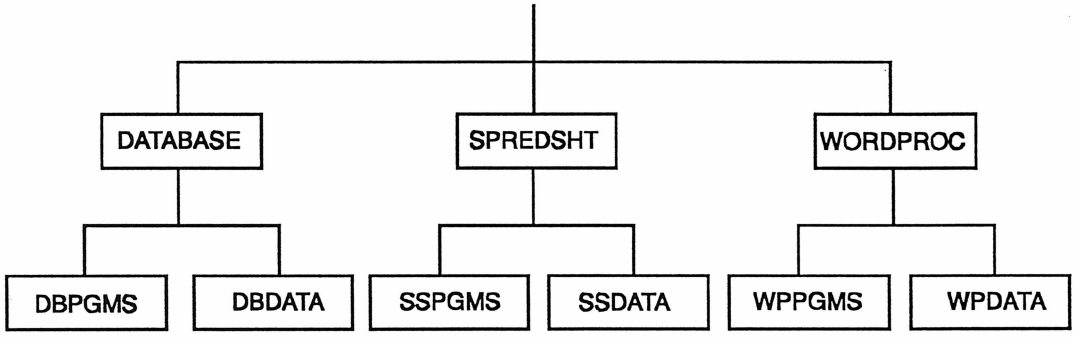
We call these partitions **DIRECTORIES**, and so, we may have three directories: DATABASE, SPREDSHT, and WORDPROC:



Within each directory, we may have several types of information. For example, our word processing directory may hold:

- Letters
- Memos
- Reports
- Forecasts.

If we're smart, we'll also separate these within our word processing directory, because it will help us find a particular file later on. We can make **SUBDIRECTORIES** within each directory to keep the different kinds of work we do separate, like letters, memos, and reports. Or we might want to keep our data files separate from our program files:



The terms **directory** and **subdirectory** are interchangeable, because every directory is a subdirectory of another.

Directory-oriented Commands

Root directory

If directories keep track of files, how do we keep track of the directories? Every disk has a master index that lists the directories on the disk. We call this the **root directory**.

The root directory can hold files too, but that's not its main purpose. It's really the top level directory, and it lists the first level of directories on the disk and contains the tables that tell DOS where everything is on the disk. Every disk **must** have a root directory (even floppy disks), and DOS makes the root directory for us when we format a disk. We can delete every other directory on a disk, but we can't delete the root directory.

Backslash

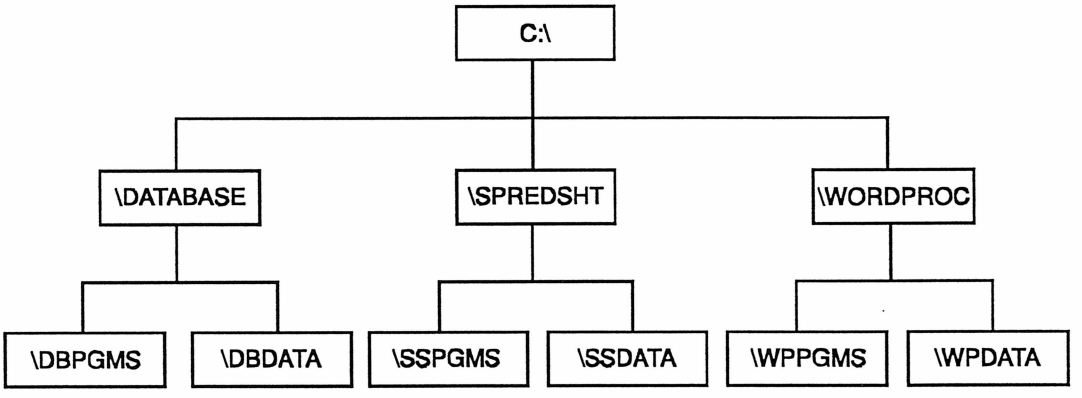
In DOS commands, we denote the root directory by a backslash, \

We denote our floppy disk drives by A: and B:, and we denote the root directory of the floppy disk in A: by A:\, and of the floppy disk in B: by B:\

Similarly, we denote our hard disks by C:, D:, and so on, but we denote their root directories by C:\, D:\, and so on.

Tree structures

We can imagine the directory structure like an upside down tree, with the root at the top and the branches going downward:



Directory naming

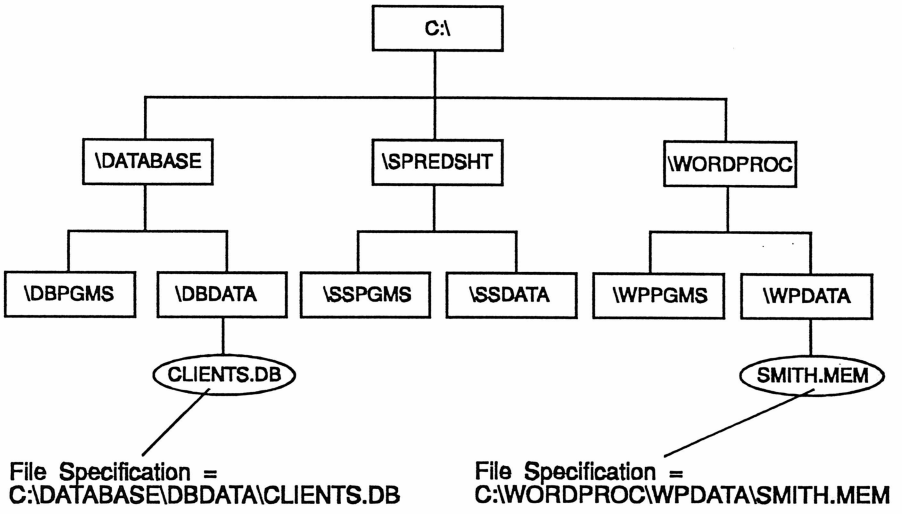
Directories must have names, just like filing cabinets. The rules for naming directories are the same as for file naming. That is, directory names can be up to 8 characters long, and must be unique. We must also avoid the same reserved characters as for file naming.

[DOS 5.0]

From DOS 5.0, we can include extensions in directory naming.

File Specifications

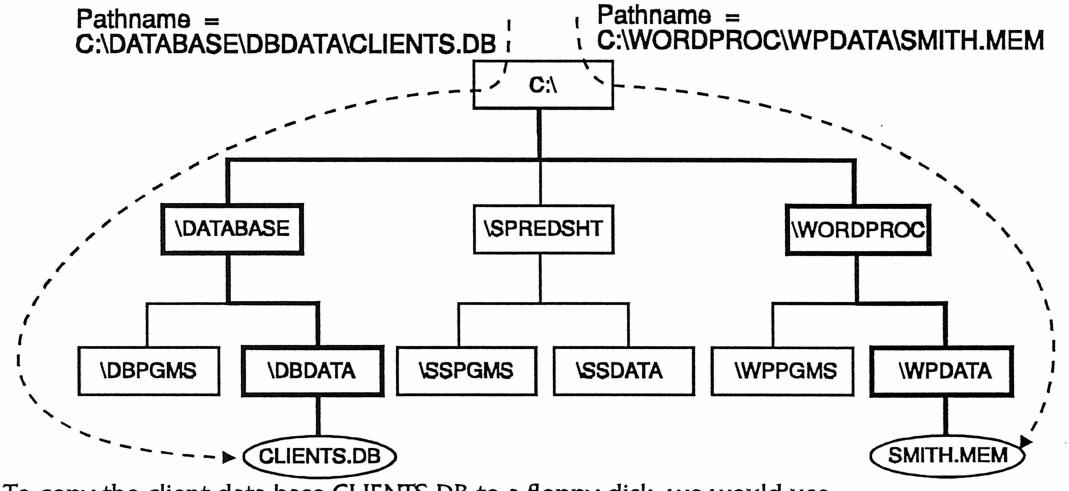
Now that we're dealing with directories, a file's name is only part of its identification. We must also tell DOS where to find the file. Therefore, the full file specification consists of **Drive letter + directory + filename.ext** as in **C:\DATABASE\DBDATA\CLIENTS.DB**



File names must be unique within a directory, but not within the entire disk. Thus, we could have a file called SMITH.MEM in other directories.

Navigating the tree

In order to tell DOS how to get to a particular file, we must give it directions for navigating the tree. We call the route that DOS must take the **path,** or **pathname**. The pathname must include the names of all the directories that DOS must traverse to get to the file from the root directory.



To copy the client data base CLIENTS.DB to a floppy disk, we would use:

```
C:\>COPY  C:\DATABASE\DBDATA\CLIENT.DB  A:\
```

or, to copy a new customer data base from a floppy:

```
C:\>COPY  A:\CUSTOMER.DB  C:\DATABASE\DBDATA
```

Default (current) directory

Typing out long pathnames is very tedious and we might make mistakes. DOS gives us a short cut. We can tell DOS that a particular directory is the **CURRENT DIRECTORY**, or **DEFAULT DIRECTORY**.

If we make **C:\DATABASE\DBDATA** the current directory, then DOS assumes that every command we type refers to that directory and the files in it. This saves us retyping long directory names over and over.

We use the **CHANGE DIRECTORY** command to do this, shortened to CD:

```
C:\>CD  \DATABASE\DBDATA
```

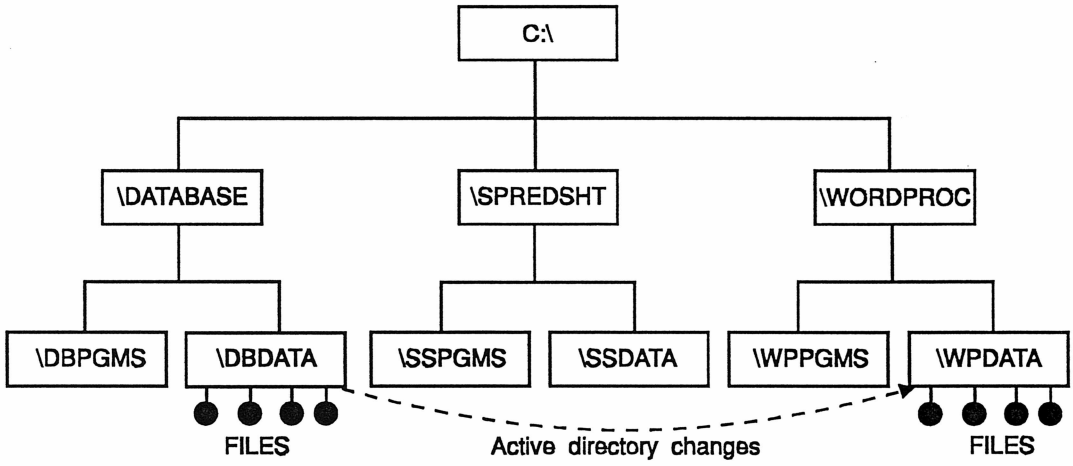
This changes the active, or default, directory to C:\DATABASE\DBDATA

So, if the current directory is C:\DATABASE\DBDATA, we change the default again with:

```
C:\DATABASE\DBDATA>CD  \WORDPROC\WPDATA

C:\WORDPROC\WPDATA>
```

and begin to work on the files in \WPDATA without having to keep specifying the full path name.



If we now copy files from A: without over-riding the default, DOS assumes that we mean the current directory:

```
C:\WORDPROC\WPDATA>COPY  A:\*.*
```

causes DOS to copy all the files on A: to the directory \WORDPROC\WPDATA.

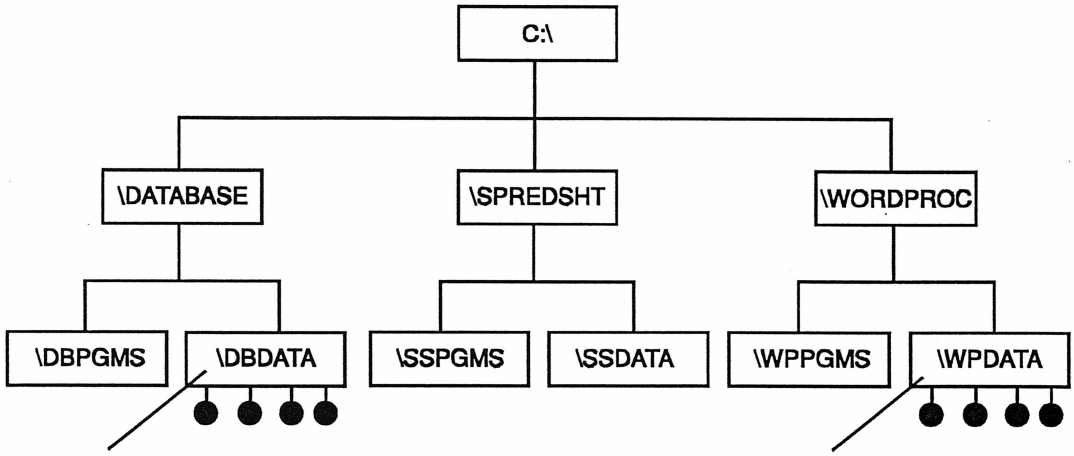
Over-riding the default

We can still make commands that affect other directories simply by including the full path name in the command. This over-rides the default:

```
C:\WORDPROC\WPDATA>COPY  A:\*.*  C:\DATABASE\DBDATA
```

and

```
C:\WORDPROC\WPDATA>COPY C:\DATABASE\DBDATA\CLIENT.DB A:\
```



With a DOS prompt of:

C:\WORDPROC\WPDATA>

we must over-ride the default to specify files in this directory

With a DOS prompt of:

C:\WORDPROC\WPDATA>

we DO NOT over-ride the default to specify files in this directory

When do we change the default?

The benefit of setting a default is that it saves us typing time and increases accuracy when we are doing a lot work in one directory. If our current directory is \DATABASE\DB_DATA and we want to see a list of all the files in WORDPROC\WP_DATA, then we could **over-ride** the default for that one command:

```
C:\DATABASE\DBDATA>DIR  \WORDPROC\WPDATA
```

and DOS would list the files in \WORDPROC\WPDATA without changing the current directory.

But if we've finished in one directory and intend to do a lot of work in another, like \WORDPROC\WPDATA, then we would change the default:

```
C:\DATABASE\DBDATA>CD \WORDPROC\WPDATA
```

Notice that if one or both directories are on the active drive, we don't need to include the drive letter. But if we need to refer to another drive, we must include the drive letter:

```
C:\WORDPROC\WPDATA>COPY A:\*.* \DATABASE\DBDATA
```

Glossary

This glossary defines terms you will commonly encounter in purchasing and using computers. For other terms that are application-specific, refer to the program documentation for their meaning. In the following definitions, terms in bold italics also appear in the glossary in their own right.

A

abort Deliberate or unexpected termination of a program. You can instruct a program to suspend during a long operation like printing or data base searching, or a program may hang up due to bugs, incorrect input, hardware malfunction, or an unexpected condition. (Applications running under Windows 3.0, for example, may abort due to data and programs being overlaid in memory. You will get the message "Unrecoverable Application Error," and you must exit Windows and restart. (also known as a crash)

access time The time a program or device takes to retrieve data and make it available to the microprocessor. Access times for memory (also called random access memory, or RAM) should match the processor's speed. Typical RAM access times are 15 to 50 nanoseconds (billionths), allowing about 20 million cycles per second. Because hard disks are mechanical devices, typical hard disk access times are 10 to 100 milliseconds (thousandths), allowing about 10 to 100 accesses per second. Even though disks are fast, notice the wide difference between RAM and disk access times. To speed up your work, when you buy a computer, go for as much RAM as you can afford.

adapter A printed circuit expansion board that provides specialized processing and control on behalf of the microprocessor. It fits in a computer's expansion slot and supports a device like a monitor or a mouse, or connects a computer to a network.

alphanumeric The set of letters (A - Z) and numeric characters (0 - 9). File names and field entries are often limited to these, plus the characters @, #, and $.

Alt key Short for Alternate key. Like the Control (or Ctrl) key, holding down the Alt key modifies the function of other keys. Manuals usually express this as "Alt + key."

analog Continuous rather than discrete, or digital. For example, clocks and watches can be analog (continuously sweeping hand) or digital (discrete read out that jumps from one minute or second to the next). Early monitors were analog, but EGA and VGA monitors accept digital signals from the computer and translate them into analog for display.

ANSI Acronym for American National Standards Institute, which determines the standards for many technical areas, including computers. Greatest impact is in how computers represent the characters we work with. Windows applications use the ANSI character set, whereas DOS applications use another standard known as ASCII. For example, the letter "a" is represented by the numbers 97 in ASCII and 097 in ANSI. But the numbering diverges for non-standard characters, for example ANSI 0169 and ASCII 189 both mean ©. In order to insert these special characters, you must know which system your program uses. If you run Windows on a DOS machine, you will see a device driver file called ANSI.SYS in your CONFIG.SYS file tells DOS that this is an ANSI machine.

applications Programs intended for users, like word processing, graphics, data base, and spreadsheet programs. Application programs sit on top of the other major type of programs, operating system programs, that interact directly with the hardware.

arrow keys Cursor control keys that govern the movement of the screen cursor or pointer. Their operation may be different when used in combination with other keys, like Control, Alt, Shift, Home, End, Page Up, and Page Down.

ASCII Acronym for American Standard Code for Information Interchange. Provides a standard representation for English characters using numbers from 0 to 127 that allows data to be exchanged between different types of computers. Extended ASCII uses the range 128 through 255 for additional non-English characters like ". When IBM adopted ASCII representation for the PC, the rest of the industry followed, so ASCII is now the de facto standard. Windows applications, however, use the ANSI standard. Text files stored using the ASCII format are called ASCII files, and all word processors support this format. If you have difficulty moving documents between incompatible word processors, use the ASCII format. However, this format does not support any formatting, like tabs, centering, and indentation.

asynchronous A communications protocol in which either or both ends can transmit as they wish, as in a normal telephone conversation. In order for the receiver to know what's going on, the transmitter must include start and stop bits at the beginning and end of the message. (These increase the size of a transmitted byte to 10 bits rather than the 8 that are required for the computer's normal internal data representation.) The opposite of synchronous in which each end must wait for its designated time to transmit.

AT Advanced Technology, or the computer that IBM introduced in 1984, based on the Intel 80286 microprocessor running at 8 MHz. Also the first machine to use the 1.2 MB, high density floppy disk drive. Used the Industry Standard Architecture (ISA) for internal data movement, and was the standard for 3 years until IBM brought out a new internal architecture called the Micro Channel Architecture, or MCA. In response, IBM's competitors developed the Extended Industry Standard Architecture, or EISA. EISA is not compatible with MCA, so expansion boards for one will not work with the other.

attribute A quality or characteristic. In DOS, files have attributes like read only, hidden and visible, and last backup date. These can only be modified using the DOS ATTRIB command.

autoexec.bat Automatic execute batch file. DOS automatically executes this file during the computer boot sequence. Use it to hold files that you want executed during booting, like the PROMPT and PATH commands. Also, if you normally use only one application program, you can go straight to the program from within the autoexec.bat file by including the sign-on command (e.g., "WP" for WordPerfect) within the batch file.

autosave Feature of many application programs by which they save your data files at regular intervals, like 5 minutes. If you tend to forget to save your work regularly, this is an invaluable feature.

B

background Multi-tasking computers can run more than program at one time. However, only one program can usually accept input from the keyboard. This is called the foreground process, as opposed to others, called the background processes. Print spoolers are commonly run in the background. These drive the printer from a disk file while you are doing other work in the foreground. The most common example of multi-tasking is Microsoft's Windows.

backslash The character \. In DOS, \ represents the root directory and is also used to separate directory names in a pathname.

backspace A key that moves the cursor one position back, deleting the character. Differs from the Delete key that deletes the character at the current cursor position.

backup The act of copying files from one medium (usually a hard disk) to another (usually floppies or tape) for security. DOS provides primitive backup facilities, but powerful and sophisticated backup software is available (and recommended).

bad sector A sector of a track on a disk that is unusable for some reason. This is inevitable during the manufacturing process, and when DOS (or similar) formats a hard disk, it locates bad sectors and marks them as unusable. If a hard disk sector goes bad after that, data may be lost and can be recovered only by special utility programs like Norton and PC Tools. (A disk utility is strongly recommended for anyone using a computer professionally because hard disk crashes are not uncommon, and a disk utility is the only way to recover your data.) Floppy disks should not go bad, but if they do, try to recover as much data as you can and discard the disk.

batch file A file that contains a set of commands that you execute frequently. Batch file names have the extension .BAT and can be run by issuing a command containing the filename. For example, a simple DOS batch file called START.BAT could be invoked by entering START, and could contain:

```
DATE
TIME
PROMPT [HELLO]
```

This would prompt you for the date and time, and display the prompt HELLO. (The autoexec.bat file is the most obvious example of a batch file.)

baud rate Used in communications to indicate transmission speed. A baud, named after the French engineer Baudot, is normally one bit per second. It takes 10 bits to represent a character, and modems typically run at 2400 bps, or 240 characters per second. (We rate modems in bps rather than baud because, due to clever electronics, we can get more than one bit in a baud.)

bios Basic Input/Output System, encoded in a read only (ROM) chip. BIOS governs the internal operation of the machine and literally tells the machine how to be a computer, like how to write to a monitor and read from a disk drive. BIOS is put on a ROM chip to prevent alteration and corruption. All IBM-compatibles use basically the same BIOS, and DOS provides additional functions.

bit A binary digit, taking the value 1 or 0. The computer represents a character using 8 bits.

boot The process of starting up a computer, involving a self-checking diagnostic and progressively loading the operating system. Can be a cold boot (from a no-power state), or a warm boot (reload operating system without the preliminary system self-check).

Break key Special keyboard key used to suspend certain functions. Used by only a few programs, notably communications.

browse A mode used by word processing and data base programs in which you can view data quickly but not change it.

buffer Temporary data storage, usually within RAM, to hold data before or after being processed by the microprocessor. During a work session, editing changes you make to a file are not written back to the disk each time, but held in a buffer and sent to disk when you save. This allows the changes to be recorded at the same speed as the processor works rather than wait for a time-consuming disk write. Another common use for buffering is in printing. Printers are extremely slow compared with the CPU, so the data to be printed is put in a buffer from which the printer driver can take it at the printer's speed. We call this print spooling.
In DOS machines, buffers are 528 bytes. You can tell DOS how much RAM to set aside using the BUFFERS command in your CONFIG.SYS file. For example, the command "BUFFERS=30" will reserve 15 KB of RAM.

bug An error or defect in software that causes it to malfunction. The term originated when an insect was "fried" across two terminals of one of the first computers.

bus The internal "highway" connecting all the parts of the computer and supporting very high rates of data exchange. Buses can handle 16 or 32 bits simultaneously, hence the term 32-bit machine. (Note that the 80386 is a 32-bit chip but is often combined with a 16-bit bus, thus limiting the chip to 16 bits simultaneously.) There are three types of bus:

- Industry Standard Architecture (ISA) used on the PC/XT (8-bit) and PC/AT (16-bit). Runs at 8 MHz clock speed.
- Micro Channel Architecture (MCA). Requires Intel 80386 or 80486 processor and runs at 10 MHz.
- Enhanced Industry Standard Architecture (EISA), a 32-bit, 8 MHz bus developed by IBM's competitors.

bus mouse A mouse that connects directly to the bus using an expansion board as opposed to a serial mouse that requires a serial port.

button In graphical user interfaces (GUI's), a box on the screen in which you can click to select an option or a command.

byte A unit of storage for holding a single character. (A byte is made up of 8 bits (or binary digits) because it takes 8 binary digits to represent a character, and 10 bits for data communication.) Storage is measured in thousands of bytes (kilobytes, KB), millions (megabytes, MB), and billions (gigabytes, GB).

C

cache An area of high-speed storage used to hold the data most recently accessed from a disk. If the data is needed again, the processor looks for it in the cache before going to the much slower disk. Caching can speed up data access by a factor of a thousand. Computers use two kinds of cache:

- Disk caching. Involves holding the most recently accessed or written disk data in a special area of RAM. The processor looks there before making a ponderous disk access.
- Memory caching. The 80486 microprocessor contains 8 KB of super fast memory for the current data, and looks there even before going to the slower RAM. Other machines use an area of special RAM that is faster than normal RAM.

calculator A program that simulates a calculator on the screen. Using the numeric keypad, you enter numbers just like a physical, hand-held calculator, but with Windows, for example, you can transfer the result to the clipboard and use the data in another program.

calendar A program that allows you to record appointments and other data within the computer. The program can enter standing engagements automatically, and remind you of their approach.

Caps Lock key The key that, when pressed, switches the keyboard to uppercase until pressed a second time.

cartridge Removable read only memory used, for example, to add fonts to a laser jet printer, or to contain the programs for computer games. The cartridge fits into a special slot in the device.

cascade An arrangement of windows so that they overlap. (The alternative is a tiled arrangement.)

case The feature that distinguishes uppercase from lowercase. Some programs are case sensitive, that is, a command will execute differently depending on the case. DOS is case insensitive.

CD-ROM An optical disk, using the same technology as audio CDs, capable of holding over 500 MB per disk, equivalent to about 1000 floppy disks. Like audio CDs, they are recorded once by the vendor, but can be read an unlimited number of times. Used for reference data.

cell In spreadsheets, the intersection of a row and a column, able to hold a numeric value, formula, or text. Cells are usually identified by the row/column coordinates, so the cell at the intersection of column B and row 4 is addressed as B4.

CGA Color Graphics Adapter, the first color graphics monitor standard, developed by IBM in 1981. Very low resolution by today's standards (640 x 200 pixels).

CGM Computer Graphics Metafile, the ANSI standard file layout for the exchange of vector graphics between graphics programs.

character Any symbol requiring one byte of storage, but normally used for letters, numbers, and punctuation.

character-based Programs that treat the monitor screen like a grid of small boxes to hold characters, typically 25 rows and 80 columns. (The alternative is graphics-based, that treats the screen as millions of tiny dots, called pixels.)

click To depress a mouse button and immediately let go. Usually used to select the icon or option on which the pointer or cursor is currently resting. In many programs, double clicking chooses an icon and instructs the program to execute your choice. Differs from dragging (holding down the mouse button while moving the mouse) to move an item on the screen.

client/server A network of computers in which one computer is dedicated to serving the others (its clients) by, for example, managing large data bases or the network's printers. Client machines are often less powerful than the server. (Differs from peer-to-peer networks in which each computer has similar responsibilities but can communicate with all the others.)

clip art Preformed illustrations or graphic images that can be selected and inserted into documents by word processing and desktop publishing programs.

clipboard A special buffer used by application programs to hold data temporarily during a cut and paste operation. For example, Ventura Publisher maintains three clipboards: frame, text, and graphics. Going further, the Windows graphical environment allows data to be moved between application programs running under Windows.

clock speed The rate at which a microprocessor executes instructions. An internal clock synchronizes the various parts of the computer, and a simple multiplication may take about 20 clock cycles. But a 33 MHz processor makes 33 million cycles per second, so could perform about 15 million multiplications per second, if it could get the data fast enough. Some computers let you to slow the clock speed down (say from 33 to 12 MHz) to match speeds with slower add-on devices or human operators. In this case, the normal speed is called turbo speed.

clone A computer or device that is internally the same as another and performs exactly like it. So, an IBM clone, for example, is built just like an IBM original. This differs from an IBM-compatible, which need not be internally identical but is able to run any program that the original can, and produce exactly the same results.

cold boot Starting a computer up from a no-power state. Differs from a warm boot.

COM file A DOS-based file of executable commands. Must have a .COM filename extension. Limited to in size to 64 KB, so large program files are usually made .EXE files.

command A specific instruction to the computer, given by typing reserved key words (like FORMAT), using function keys, or selecting choices from a menu. The command consists of the function to be executed, and optionally parameters like file names or drive letters, as in:

FORMAT A:.

command line The line on the screen where you type the command, usually against a prompt, like C:\>

communications The transmission of data between two computers, and includes the equipment and software needed to route, transmit, and verify data, such as modems. Software features include queuing and dialing, message editing, remote machine access, unattended response, transmission spooling and emulation (making a computer look like one of another type).

compatibility The ability of hardware or software to work with other hardware or software, for example, most printers are compatible with most computers through a piece of software called a driver. Many programs will read data produced by other programs of the same type (like word processors) in order to be more attractive to users. (In cases of rampant incompatibility, a technique called emulation can be used, in which the hardware and/or software is deliberately fooled into thinking that a device is actually a type with which it can communicate.)

computer A programmable machine which executes a predefined set of instructions, or program. In addition to the microprocessor, a computer consists of memory or RAM, mass storage such as a hard disk, input devices such as a keyboard and mouse, and output devices such as a monitor and printer.

CONFIG.SYS A file that defines the computer to DOS that is read as part of the boot sequence. DOS executes any commands it finds, like "DEVICE =" commands which inform DOS of special features like memory management software or disk caching.

Control key Used in conjunction with other keys, the Ctrl key modifies their operation.

controller A device that relieves the microprocessor of some control responsibility, for example, the transfer of data to and from disks, keyboards, monitors, and printers. A new external disk, say, will also require a disk controller that is compatible with the computer's bus. (Also known as an adapter and an expansion board.)

copy With DOS, the function of duplicating a file in the same or another directory. In application programs, the duplication of text within a document, a record within a file, or a graphics element (line, circle, etc.) within a graphic image.

copy protection The technique of preventing the copying of a program. Popular at one time with vendors, copy protection is now uncommon because of technical difficulties and ease of circumvention.

cps Characters per second. Used to measure of the speed of dot matrix printers.

CPU Central Processing Unit, or microprocessor. Consists of an arithmetic unit, a control unit, and possibly high-speed RAM.

cursor The indicator used on screen to indicate the position at which the next character entered will appear. Usually a blinking vertical or horizontal line.

cut In applications, moving a block of text or a graphic element to a clipboard for later pasting.

cylinder The vertical set of tracks on a hard disk.

D

data Information (text, numbers, graphics, and so on) usually formatted for a specific application.

data base A collection of data organized in ways that allow fast access. Data is structured by fields within records within files. For example, "SMITH" occupies the "last name" field within Smith's record, and his record sits with all other records of the same type in, say, the Customer file. We use a data base management system (DBMS) to organize the records, sort them, extract them, operate on all or just a few, and print them. DBMSs also support powerful query and retrieval languages. (dBase, by Ashton-Tate, is probably the most well-known DBMS.)

default The value that a program or device uses automatically unless you provide a different value. For example, the manufacturer may set your modem to a default speed of 2400 bps, or you may set your default directory to C:\WORDPERF\WPDATA. This setting will be used until you change the default or override it in a specific command.

delete Removal of: (1) a file from a disk, or (2) text, a record, or a graphical element from a file.

Delete key The Del key removes the current character, field or graphical element. With a word processor, deletes the character at the cursor, which differs from the Backspace key which deletes the character to the left of the cursor.

density The measure of how tightly packed information is on a disk. Floppy disk drives, for example, can be double density, or high density. Increased density requires better quality magnetic coating and better engineered components. It is unwise to use a disk at a density higher than its rating, so don't format a double density floppy as high density.

desktop publishing An application that allows more sophisticated page formatting than a word processor, particularly in layout, type faces, margins and justification. DTP programs display the exact printed output on the screen, or WYSIWYG, for "what you see is what you get."

destination The target file, directory, or device in DOS commands which move data from one file, directory, or device to another. (Opposite of source.)

device A hardware component attached to a computer, such as disk drives, printers, and modems.

dialog box An area of a screen that presents information and/or requests you to make a choice, usually by pointing and clicking with a mouse.

digital Discrete rather than continuous, or analog. For example, clocks and watches can be analog (continuously sweeping hand) or digital (discrete read out that jumps from one time to the next). Early monitors were analog, but EGA and VGA monitors accept digital signals from the computer and translate them into analog for display. Computers handle digital data more easily than analog data, but because analog data is more suitable for humans, the computer must translate digital to analog for display, and back again for internal processing.

directory A partition of data files on a magnetic disk into a hierarchical structure. Think of a directory as an inverted tree, with files at one level contained within the directory at the next level up. In order to access a file at any level, you must give DOS the names of all the directories directly above it, or the pathname. The topmost directory is called the root directory, and each directory below that is called a subdirectory (although often called just a directory).

disk A round plate, made of magnetic material or optical material, on which data can be encoded. Data on a magnetic disk can be erased and recorded over, but data on an optical disk is usually recorded once only. Magnetic disks include:

- Floppy disk, typically 5¼" and 3½", holding 1.2 MB and 1.44 MB respectively. Also includes the Bernoulli Box, holding disks of up to 20 - 40 MB.
- Hard disk, storing from 10 MB to 5 GB.
- Disk cartridge, typically with a 40 MB capacity. Uses an external drive into which the disk cartridge is placed like a floppy disk.

Optical disks include:

- CD/ROM. Written by the manufacturer, for read only (as with the music CD).
- Write-once, read-many, or WORM. Blank disks on which you can write once only.
- Erasable optical, or EO.

All disks require a hardware disk drive with one or more read/write heads.

disk cache A portion of RAM used to hold the most recently accessed disk data. When a program needs data from the hard disk, DOS first checks the cache in order to avoid the disk access, and when a program wishes to write data to disk, DOS temporarily stores it in the cache, writing it to the disk later for permanence. Caching significantly speeds processing.

disk drive The device that rotates a disk and is equipped with heads to read and write data. Access times vary from about 500 ms for a floppy disk to 12 ms for a hard disk.

DOS Disk Operating System, the standard operating system for IBM-compatibles. "DOS" can be prefixed by MS- (Microsoft's version) or PC- (IBM's version). There have been about ten versions over the last decade, most notably DOS version 3.3 in 1987 that first supported 1.44 MB floppy disks, multiple hard disk partitions, and improved backup. Version 5.0 in 1991 offered an improved shell and managed memory (RAM) above 640 KB.

dot matrix printer A printer using a head made of an array of pins fired against an inked ribbon next to the paper. The pin array can contain from 9 to 24 pins, fired to approximate the shape of characters. Print speed varies from about 50 characters per second (cps) to over 500 cps.

dragging Moving a mouse across a monitor screen while holding down a mouse button. This has the effect of selecting a block of text or group of symbols for further action, or moving the select text or symbols across the screen.

driver A program that controls a device and acts as a translator between application programs and the device. For example, an application may issue a generic "print" command that the driver converts into specific instructions for the particular printer. As part of installing an application, you must tell the install program what type of printer, mouse, etc. you are using. The installation software will copy the appropriate driver from the installation software kit.

E

editor A program that allows you to create and edit text files. Can be a primitive line editor (like EDLIN) or a screen editor like Window's Notebook. Screen editors differ from word processors by having only primitive formatting capabilities.

EDLIN The DOS line editor which allows you create, edit, or delete one line of an ASCII text file at a time.

EGA Enhanced Graphics Adapter, a monitor resolution standard supporting 64 color, 640 x 350 pixel resolution.

EISA Extended Industry Standard Architecture, a 32-bit bus designed to compete with IBM's MCA, and based on the Intel 80386 and 80486 microprocessors.

electronic mail An application that allows messages to be sent, stored, and received between the users of computers and terminals on a network. Usually supports party-to-party and broadcast messages. (Often called E-mail for short.)

emulation The ability of a program or device to imitate another, thus allowing other devices or programs to work with it. Printers, for example, are often made to emulate Epson dot matrix or Hewlett-Packard laser jet printers because these have become the industry de facto standards.

End key A keyboard key whose usage depends on the program running at the time. For example, may move the cursor to the end of the line, page, or file.

EO Erasable Optical disk, on which users can write and over-write data. Able to store up to 1,000 MB on one 5¼" disk. Access time of 60 to 500 milliseconds is about that of a floppy disk.

Escape key (ESC) Used to send an escape character to the computer to abort the current operation or move back up one level in a menu hierarchy.

executable file A file of instructions written directly for the machine, and not readable by humans. For DOS systems, held as either a command (.COM) file, or an executable (.EXE) file.

expanded memory DOS machines can handle up to 1 MB of memory (RAM). The lower 640 KB is known as conventional memory and the upper 384 KB as expanded memory. The latter is reserved for special purposes and is not available to hold data. Differs from extended memory which until 1990 could only be used by special programs like RAM disks. But Windows 3.0, introduced in 1990, contains an extended memory manager,. As a result, expanded memory is more restrictive than extended memory, and has became less popular.

expansion board A printed circuit board that can be installed in an expansion slot in the computer to boost its memory or CPU power or to provide special facilities such as a video adapter.

expansion slot A connection on the mother board to take a plug-in printed circuit expansion board such as a video adapter. Depending on the number of pins, the connector is called half-slot or full slot.

exporting The output of data from one application so that it's formatted for immediate processing by another, for example, when a graphics program prepares clip art for pasting by a desktop publishing program. (The other side of the coin is importing.)

extended memory Memory above the 1 MB of main memory supported by DOS. Available only with Intel 80286, 80386, and 80486 microprocessors. Expanded memory must be specially configured for use by DOS, but extended memory consists of raw memory chips and cannot be used by most programs without a special extended memory driver such as that provided by Windows. 80386 and 80486 can convert extended memory into expanded memory, however. For ease of installation, chips are supplied as a SIMM.

extension Up to 3 characters that can be added after a filename to indicate the type of file. DOS recognizes .BAK, .BAT, .COM, .EXE, .LIB, .MAP, and .OBJ, and you should not use these for your files. You are free to choose other extensions that do not conflict with your applications. For example, Ventura Publisher reserves .CAP, CHP, .CIF, .VGR, .IDX, .PUB, and .STY for its own use. If you use an extension, separate it from the filename by a period.

external commands DOS commands that do not reside in the COMMAND.COM file. The files containing instructions for executing these commands, such as FORMAT.EXE, must be made available to DOS. (COMMAND.COM commands are called internal commands.)

external modem A modem not contained as an expansion board within the computer. They attach to the computer via a serial port. Advantages over internal modems are that status lights are visible and they can be moved between computers.

F

FAT see File Allocation Table

field The space allotted for an item of data, such as name field or address field. They can be restricted to letters and/or numbers, and stipulated to be mandatory, optional, or calculated. A collection of related fields is termed a record.

file Any collection of related data, such as the instructions making up a program, a single span of text, a group of data base records, or an arrangement of graphical elements making up an image. Many programs store formatting and control information with the data.

file allocation table The hidden file used by DOS to place and retrieve files on a disk. If a disk's table becomes corrupt, the disk is unusable and the data inaccessible. In this case, you must use a disk utility such as PC Tools or Norton Disk Doctor to rebuild the FAT.

filename The name of a file. Must be unique within a directory but can be duplicated across directories. DOS imposes an 8 character limit on size and excludes some characters. Can be accompanied by an extension to indicate the file type.

floppy disk A flexible magnetic-coated disk that can be inserted into a device that can write and read encoded information. The most common sizes are 5¼ inch, with a capacity of 1.2 MB, and 3½ inch, with a capacity of 1.44 MB, although some laptop computers use a 2 inch, 720 KB disk.

font The combination of a typeface and size, for example, Times Roman 12 point, or Helvetica 72 point. Fonts are held in two ways:

- Bit-mapped, in which every character in a font is held as an array of dots. To print the character, the array is sent to the printer, and because it has been predefined, it only need be retrieved from memory, which is faster than with scalable fonts. However, bit-mapped fonts take up more disk space (several megabytes), and are usually generated in 1 or 2 point increments. This is a problem when you resize a graphic because the text will change in jumps and not smoothly like the graphical elements.
- Scalable, in which only a generic outline of the character is held in memory, regardless of size. The actual character to be displayed or printed is calculated at display or print time. The scaling operation takes processing time, but allows tiny increments of sizing (excellent for graphics). Also the outlines take up less disk space than bit-mapped because only one outline is stored for each character in the face.

foreground Multi-tasking computers can run more than program at one time. However, only one can usually accept input from the keyboard at any one time. This is called the foreground process, as opposed to background processes like print spoolers that drive the printer from a disk file while you are doing other work in the foreground.

format The process of preparing a disk to receive data that lays down the tracks that DOS will use. Hard disks require low-level formatting (done by the manufacturer) and high-level, or user formatting, often done by the dealer. When formatting a floppy disk, be very careful to include the drive letter in the command. If you just type FORMAT against the C:\ prompt, DOS will assume that you intend to reformat your hard disk, so make sure that you type FORMAT A: or FORMAT B:

formula In a spreadsheet, an expression that defines how one cell relates to another. For example, the formula +A6*B3 in cell B4 means "multiply the contents of cell A6 by the contents of cell B3 and put the result in cell B4." If the values in cells A6 and B3 change, the application will recalculate the result.

fragmentation When a file is written to a disk, DOS makes use of available space and may break the file up, placing it in several different parts of the disk, that is, DOS fragments the file. Under heavy usage, the files on a disk can become so fragmented that reading and writing are slowed down. For floppy disks, you can use the COPY or XCOPY command to copy files to another floppy. DOS reconstitutes the file during reading, and writes the file to a contiguous area on the target disk. This is not feasible on a full hard disk, however, so you should use a disk optimizer like those provided with PC Tools or Norton Utilities.

function keys Special keys, labelled F1 through F10 or F12 that provide short cuts for telling an application what to do. Different applications use them differently, and often in combination with the Control and Alt keys.

G

GEM A graphical user interface (GUI), developed by Digital Research Inc., that provides access to an application program's facilities through icons and menus to which you point with a mouse. Used for application programs like Ventura Publisher and GEMDRAW.

gigabyte One billion bytes. (More precisely, when counting computer storage, a GB is 1024 MB or 1,073,741,824 bytes because, unlike engineers, we count bytes in multiples of 2)

graphical user interface (GUI) A program that uses the monitor to provide access to an application program's facilities through icons and menus to which you point with a mouse. Notable examples include GEM and Windows. A GUI avoids the need for application builders to invent their own interface. The use of symbols for functions and commands frees the user from having to learn the command language. A GUI usually consists of:

- Multiple windows for displaying files or running programs
- Icons to represent programs, commands, files
- A mouse-driven pointer for selecting icons, files, etc,
- Menus for command selection

graphics Computer facilities (printers, monitors, adapters) that work with pictures and images rather than text. Graphics applications include:

- Paint programs, i.e., bit-mapped freehand drawing programs
- Drawing and design programs working with vectors (lines and shapes that can be expressed mathematically such as Bezier curves).
- Presentation graphics programs specializing in bar charts, pie charts, clipart and so on for presentations
- Desktop publishing programs, involving page layout, graphics, and other design elements.

graphics file formats There are several file formats for representing graphics images:

- BMP: a bit-mapped format for Windows
- CGM: Computer Graphics Metafile (in common use)
- DXF: Data Exchange File, used by computer-aided design applications
- EPS: Encapsulated Postscript, combining Postscript commands and TIFF format
- GEM: A format used by the GEM GUI
- HPGL: Hewlett-Packard Graphics Language. Widely used but not sophisticated)
- PCX: Developed by ZSOFT for PC Paintbrush, now in common use by many other applications and optical scanners
- PIC: Picture File created to represent Lotus 1-2-3 graphics and now supported by many other applications
- TIFF: Tagged Image File Format, the industry standard for bit-mapped images
- WMF: Windows Metafile Format, for exchanging files between Windows applications.

graphics-based Programs that treat the screen as an array of millions of pixels. The alternative is character-based applications that treat the monitor screen like a grid of small boxes (typically 25 rows and 80 columns) to hold ASCII characters.

H

hard card A hard disk and drive mounted on an expansion card and inserted in an expansion slot. They are faster than normal hard disks and are easy to install but they take up an expansion slot.

hard disk A magnetic disk, installed within the computer, for storing data. Capacities vary from 10 MB to over 1,000 MB. Hard disks have extremely fast access, which can be further speeded by a disk cache that holds current data in RAM. Consists of a number of platters, coated on each side, each with a read/write head. Each disk is formatted into tracks, with the vertical set of tracks termed a cylinder. Three main protocols govern how data is moved between disk and memory:

- ST-506: Early standard which supports MFM and RLL encoding
- ESDI: Enhanced Small Device Interface, IBM's new standard for fast hard disks
- IDE: Integrated Drive Interface, slower than ESDI but faster than ST-506

hardware General term for physical devices

help On-line documentation that comes with a program and is available to the user while using the program. Often context-dependent, that is, the explanation you get depends on the function you are performing at the time.

hidden file In DOS, a file that users cannot access (prevents accidental corruption). Hidden files are not listed when you use the DIR command.

high density Describes floppy disks and disk drives capable of holding or handling higher densities of data, such as 1.2 and 1.44 MB. (Compare with double density, of 360 and 720 KB.)

Home key A cursor control key on keyboards, usually moving the cursor to the top left corner of the screen.

HP-compatible Laser jet printers that emulate the Hewlett-Packard laser jet printer. Many other manufacturers made their printers look like the HP pioneer because HP's Printer Control Language (PCL) has become the de facto standard and all application programs include HP printers on their list of supported printers.

I

IBM PC Strictly, the family of computers developed by IBM, but commonly used to refer to any IBM-compatible, or clone. Based on the Intel 8088, or 80x86 microprocessor. Are generally software-compatible, meaning that software written for one will run on any, within limits of speed and power. Uses two operating systems: DOS which runs on any PC, and OS/2 which runs only on Intel 80x86 models.

icon A small picture or symbol used in GUIs to represent a file, program, or function. Clicking on the icon invokes the program or selects the file.

importing The input of data prepared by another application so that it's formatted for immediate processing, for example, when a desktop application pulls in clip art for pasting that's been prepared by a graphics program. (The other side of the coin is exporting.)

industry standard architecture (ISA) The bus architecture used in the IBM PC/XT and PC/AT computers.

ink-jet printer A printer that works by spraying ink at the paper through small nozzles. Slow, but can produce very high quality, up to 300 dpi, and print in color.

insert mode Text editors and word processors work in insert mode and typeover (overstrike) mode. In the former, characters you type are inserted at the cursor position, with the characters to the right moved to the right. In the latter, you overtype as the cursor moves to the right. Toggle between the modes using the Insert (Ins) key.

Insert key Used by most text editors and word processors to toggle between insert and overstrike mode.

instruction A rudimentary statement that tells the microprocessor what to do. Each DOS command, for example, breaks down into many primitive instructions.

integrated circuit A small electronic device, made of silicon, housing thousands or millions of individual circuits. (also known as a chip.)

internal command A DOS command whose instructions are contained within the COMMAND.COM file. Differs from an external command that needs an explicit file, like FORMAT.EXE.

internal modem A modem that resides on an expansion board rather than as a separate unit outside the machine.

J

joystick A pointing device that uses a vertical lever that can move in any direction. Unlike a mouse which must be moved to move the pointer, the joystick continues to direct the cursor as long as it's off the vertical position.

K

K Short for kilo, or thousand. (In measuring computer storage, it means 1024 bytes since we count storage in multiples of 2.)

key (1) A button on a keyboard, (2) In a word processor or data base program, a field used for record searching or sorting, like "Customer Name."

keyboard Set of alphanumeric, punctuation, and special keys used to input commands and data to a computer. Most common are the AT Standard with 84 keys, and the AT Enhanced with 101 keys (also known as the 101 keyboard).

L

laptop A small, portable computer, typically weighing 16 - 20 pounds. Operated by a rechargeable battery pack with about 4 hours duration.

laser jet printer A printer that uses a laser beam to produce an image on a drum by altering the electrical charge. The drum then picks up toner (ink powder) and transfers it to paper using heat and pressure, printing an entire page at a time. Because it can replicate any shape, it can print graphics and an unlimited number of different text fonts. Fonts can be held in font cartridges or be downloaded from the computer as soft fonts. Laser printers are controlled by page description languages notably Hewlett-Packard's Printer Control Language (PCL), and Adobe's Postscript that can be used on IBM machines with special software.

letter quality Print that has the same quality as typewritten characters. Laser jet, ink jet, and daisy-wheel printers can produce letter quality.

load To copy a program from a disk to memory for execution by the CPU.

local area network (LAN) A network of computers in close proximity, such as a floor of a building or one office. Each node computer has its own CPU and possibly hard disk. The network can be configured as client/server or peer-to-peer.

LPT The name used by DOS to identify a printer, as in "LPT1 is the device connected to parallel port 1," and often used to refer to the parallel port. Some versions of DOS also use the abbreviation PRN for printer.

M

M Mega, one million, as in megabyte (MB) or megahertz (MHz). (Actual value is 1,024,000)

MCA Micro Channel Architecture. A bus developed by IBM for its PS/2 range and other high-end machines. It is a 32-bit, 20 MHz bus, and can support several CPUs. It is incompatible with IBM's earlier AT bus and old expansion cards will not work with MCA.

memory A computer's internal storage for fast access to programs and data. Composed of RAM (or main memory), ROM, and other specialized types of chip which are used to speed processing. The memory available to the user is less than the total RAM because DOS itself requires a certain amount of memory. (You can tell how much memory is available by using the CHKDSK command.) The limit used to be 640 KB unless you used a special high-memory driver, but now DOS version 5.0 can handle up to 1 MB, and up to 8 MB is common under Windows.

memory resident Programs that must not be swapped out to disk if there is insufficient memory to hold all programs needed at one time. In a memory crunch, DOS will swap all or a part of a non-resident program to disk until it's needed again.

menu-driven Programs that display a list of commands, options, or file names from which you can choose using a mouse or keyboard cursor control keys. Differs from a command-driven program in which you must memorize the commands or options.

MHz Megahertz, or million cycles per second. Used to measure the clock speed of a microprocessor.

micro channel architeture see MCA

microprocessor The silicon chip that contains the central processing unit, or CPU. Executes the low-level instructions that perform arithmetical and logic operations on data held in memory. Microprocessors form families of the same or similar type, such as the Intel 80x86 and Motorola 68000 families.

modem Modulator/Demodulator, a hardware device that allows a computer to transmit digital signals over an analog telephone line by converting the computer's digital pulses into analog signals at the transmitting end. A second modem at the receiving end converts the analog signal back to digital for input to another computer.

monitor The computer's display screen and associated graphics capabilities. Monitors can be monochrome or color, the latter able to show from 16 to over 1,000,000 colors. Screen size is typically 12 to 14 inches diagonally, although full-page monitors can be 16 inches in diagonal. The other major difference among monitors is resolution, that is, the density of picture elements or pixels. Resolution types are CGA, EGA, VGA, and Super VGA.
Monitors must be matched to their adapter card. Depending on the signal it can handle from the computer, monitors can be digital or analog. Monochrome, CGA, and EGA modes use digital (or TTL) monitors, accepting digital signals from the computer, but VGA monitors are analog and use a digital/analog adapter.

motherboard The main printed circuit board containing the microprocessor, memory, serial and parallel ports, and device controllers for keyboard, monitor, and disk drives. Because they are on the motherboard, these components do not use the bus . The board also contains expansion slots to accommodate expansion boards like the video adapter and internal modem.

mouse A hand-held device whose movements across a flat surface govern the movement of a pointer on the monitor screen. A mouse is essential for menu-driven programs, graphical user interfaces, and desktop publishing and graphics applications. Mice can be mechanical which detect the movement of a small ball in contact with the flat surface, or optical, in which an inboard laser detects the movement across a light-reflecting grid on a special mouse pad. Mice connect to the computer in two ways: into a serial port or, more complicated, to the computer's bus via an expansion board.

multi-tasking The ability to execute more than one program at a time. A CPU cannot actually execute more than one instruction at once, but by interleaving tasks at high speed, it looks as though it can.

N

near letter quality A mode in which dot matrix printers produce characters that look almost as good as typewritten output. The cost of this quality is a low print speed, typically 30 cps.

network A group of two or more computers linked together for data sharing and/or resource sharing. The term includes:

- Local Area Network (LAN) in which the machines are physically close together
- Wide Area Network (WAN), which requires telephone lines
- Integrated Speech/Digital Network (ISDN) which uses special telephone lines that can handle speech and data simultaneously.

The other important aspects of networks are:

- Topology, that is, how the nodes are connected: star, ring or bus
- Protocol, or the rules by which the nodes communicate and share data, such as token ring in which the node with the electronic "token" has control
- Architecture, such as client/server or peer-to-peer.

Num Lock key The key that toggles the numeric keypad on a keyboard from numeric mode to cursor control mode. This feature is provided because some keyboards do not have special cursor control keys, so cursor control is provided by giving the keypad a dual function.

O

off-line A printer mode used for non-printing functions like paper advancement (form feed).

on-line A printer mode in which it will accept data from the computer for printing.

operating system The program that, in effect, makes a computer's hardware into useable equipment. It performs basic internal tasks like managing disks and the transfer of data between disks and memory, reading input from the keyboard, and sending data to the monitor and printer. The major operating systems are:

- CP/M, the first personal computer operating system for IBM-compatibles
- Microsoft's DOS, introduced in the early 80's which replaced CP/M
- IBM's OS/2 for its top-of-the-line machines. Contains more advanced features than DOS, like true multi-tasking.
- Xenix, a PC version of the powerful UNIX operating system used for workstations

optical disk A CD-like disk for storing large volumes of data, up to 1,000 MB. Can be:

- CD-ROM (compact disk/read only memory), pre-encoded by the manufacturer
- WORM (write once, read many). Can be written on once by the user
- EO (erasable optical), which can be written and overwritten just like floppy disks.

optical scanner A device that scans paper and digitizes the image to create a graphics file. It works by dividing the paper into a grid of cells or boxes, and detecting whether each cell is black or white, a shade of gray, or a color. It treats the scanned piece like an array of graphic elements and produces a bit-mapped file. The file can be handled in two ways: (1) You can include the image directly in a page layout, like a photograph, using a desktop publishing or graphics program. (2) You can use a graphics program to trace the bit-mapped image to produce a vector-based image that has a much "cleaner" appearance. Even if the original image is text, scanners cannot "read" the text for editing in a word processor. For this, you need an optical scanning program.

Features of scanners to know about when buying one include:

- Resolution, a measure of the number of cells in the scanning grid, typically 75 to 300 dpi
- Flatbed, which looks like a small photocopier, or handheld in which you move the scanner's reading head across the paper
- Size. Flatbeds can be half page or full page
- Gray scaling, in which the scanner recognizes up to 256 shades of gray rather than just black or white
- Color. Expensive and produce very large files.

OS/2 The IBM operating system developed for its more powerful machines. It has both a command line like DOS, and a graphical user interface like Windows.

overstrike mode To type over an existing character at the current cursor position. (Differs from insert mode in which characters are moved to the right to make room for new characters.)

P

paint program A graphics program that allows you to create bit-mapped images. In these, the image is built by dividing the screen into an array of pixels which can be filled black or color, or left empty. They contain a number of tools that simulate the effect of a brush, roller, spray can, eraser, and so on. (Differs from a vector-based program which uses mathematical expressions to create images from lines, curves, and circles.)

parallel port An interface that supports sending several data bits in parallel, for connecting external devices, notably printers, to the computer. Uses a 25-pin connector, and is also known as a DB-25. The printer end of a cable uses a plug made of flat, gold-plated connectors, known as a Centronix interface.

parent directory The directory above the current directory. All directories have a parent except the root directory. From the current directory, the parent is indicated by two periods, as ".."

partition An area of memory or a disk, divided off for management purposes. A large hard disk, for example, may be partitioned into two or more areas, given unique drive letters. For example, you can partition a 120 MB disk into four, each partition of 30 MB and known to DOS as C:, D:, E:, and F:, say. DOS treats these like separate physical disks.

paste To copy text or graphical element from a clipboard into a document or graphic. The pasted data must first have been cut or copied on to the clipboard.

path (1) In DOS, the statement included in the autoexec.bat file that tells DOS where to look for executable files if it can't find the file in the current directory
(2) The directory structure that must be navigated to move from the root directory to the target file. (also known as pathname.)

Pause key A key used to temporarily halt the scrolling display of data when there is more data than will fit on one screen.

PCL Printer Control Language, the page description language developed by Hewlett-Packard to drive their laser jet printers. (The other major language is Adobe's Postscript.)

PCX The graphics file format, developed by ZSOFT (makers of PC Paint), and used by most optical scanners and FAX machines.

peer-to-peer A network architecture in which nodes can share data with each other and have equal responsibilities. Differs from client/server in which a more powerful machine serves (i.e. makes its resources available to) client machines. Peer-to-peer networks are simpler but can't share heavy work loads between them.

PIC The graphics file format developed by Lotus to represent graphics built using Lotus 1-2-3.

pixel Picture Element, the single point in a screen array used to represent a graphic image. In monochrome images, a pixel can be on (black dot) or off (blank), and in color images, a pixel is represented by three dots (red, green and blue) each of which can be on or off. Pixels are close together and the eye fills in the gaps to make solid images. The higher the resolution of the screen, the more solid looking the image. EGA monitors typically use an array of 640 x 200 pixels (or 128,000 pixels), and SVGA monitors use an 1024 x 768 pixel array (or 786,432 pixels).

plotter An output device widely used by designers and engineers that draws lines by means of moving pens. Differs from a printer that can only approximate lines by printing small, straight characters.

Postscript Adobe's page description language for controlling laser jet printers. It is object-oriented, meaning that it treats text as graphical objects that can be scaled in minute increments. This allows Postscript to take advantage of high-resolution monitors and printers, which the bit-mapped approach cannot.

ppm Pages per minute, the measure of a laser jet printer's speed.

printed circuit A board on which chips and other devices are mounted and connected together by lines of solder laid down in a special "printing" process.

printer A device that prints text and images on paper. Types of printer include:

- Dot matrix, which uses an array of pins to form characters, striking through inked ribbon
- Daisy-wheel, in which character shapes are arranged at the end of spokes around a hub. The wheel rotates and when the required character is at a hammer, the hammer strikes to create an impression through an inked ribbon. Limited to text.
- Ink-jet, which sprays ink through fine nozzles at the paper to form characters and images.
- Laser jet, in which a laser beam "writes" on a sensitive drum which attracts ink powder. The powder is then deposited on the paper.

The factors to consider in selecting a printer are:

- Quality. Laser jet and ink jet deliver near typeset quality, and daisy wheels produce typewriter quality
- Speed. Among impact printers, the daisy wheel is slow (30 cpm) and dot matrix is fast (up to 500 cpm). Laser jets can produce up to 20 ppm.
- Graphics capability. Daisy wheels can print only text, but the others can produce graphics of varying quality
- Fonts. Daisy wheels can print only whatever font wheel is installed; dot matrix drivers can produce a limited set of fonts; laser jets and ink jets can print an unlimited variety of fonts (typefaces and sizes).
- Noise. Impact printers (dot matrix and daisy-wheel) are noisy.

Print Screen key (Prt Scrn) The key that causes DOS to copy the current screen contents to the printer. Application programs may or may not support this key.

program An organized set of instructions that, when executed, makes the computer respond and behave in a certain way. For example, if you move a mouse in a diagonal line and click at both ends, a graphics program may draw a line between the two points, but a word processor may select a block of text. It is the set of instructions making up the program that determines how the computer will react.

prompt In DOS, the symbol > that tells you that DOS is waiting for input. You can customize the prompt to include the date, time, or name of the current directory, as in:

C:\WP51\REPORTS>

Q

QWERTY The name affectionately given to keyboards with the standard English layout because of the sequence of characters on the top row. Purposely designed in the 19th century to slow typists down, it is now a major impediment to fast typing. The fingers move 16 times further than on a Dvorak keyboard, but due to inertia, the latter has not caught on.

R

RAM Random Access Memory, the computer's internal, temporary memory that allows fast, random access to data in any location. Data to be processed by the microprocessor must be brought from an external medium like a disk before being worked on.

RAM disk An area of RAM designated to hold data normally read from or written to a disk. Provides very fast access to data, but changes are temporary until saved permanently to a real disk. DOS supports a RAM disk by means of the VDISK (Virtual Disk) command.

record In a data base application, a group of related fields, each of which contains an item of information. For example, we might hold ten pieces of information about clients, and the ten fields pertaining to one client would form a record, with one of the fields, such as last name, serving as a key field.

resolution The degree of clarity of an image, particularly as it is displayed on (1) a monitor and (2) printed out. For printers, resolution is expressed in dots per inch (dpi), and a 300 dpi laser jet printer can squeeze 90,000 dots into a square inch. With monitors, we call the dots pixels, and a 640 x 480 pixel screen has 640 pixels on 480 lines, or about 2,000 per square inch.

Return key (1) Marked Return or Enter, this key causes an application to go the beginning of the next line, as at the end of a paragraph. This is called a hard return, as opposed to a soft return which a word processor inserts as it wraps to the next line.
(2) In DOS and other command-driven programs, it tells the program to execute the command that has been entered on the command line.

reverse video A display technique that reverses the display mode, like black on white rather than white on black. Used primarily to highlight the current option in a menu-driven application.

ROM Read Only Memory, the computer memory that has been prerecorded, usually with basic operating system instructions to be executed during a boot. Unlike RAM, it retains its contents even when the power is turned off.

root directory The topmost directory in a file hierarchy. It is created by DOS when it formats a disk, and serves as a "master index" to lower level subdirectories, although it can hold files itself. It is expressed by the backslash character, as in C:\.

S

save To copy data from memory to a permanent medium such as a disk. Any changes made to data are held in memory and are vulnerable to power loss until saved. Many programs have a built-in autosave feature in which you specify the interval in minutes before the next autosave. Otherwise, you must remember to save your work.

scroll bar A vertical or horizontal bar at the side of a window to indicate the area of the entire display that is currently shown on the screen. The displayed area is usually white on gray. By pointing the mouse cursor at a point in the gray area, the program will jump to that part of the display. Alternately, you can click in the white area and drag it to the area you want. For less gross movements, you can click on the up or down arrow at the top or bottom, or at either side of the bar.

sector A subdivision of a track on a disk. DOS typically creates 10 sectors per track. We call a sector that is unusable (because of irregularities in the magnetic coating) a bad sector.

server A computer in a network that performs specialized functions for the others, termed clients. The server typically maintains large files and data bases, performs printing and network management, and is responsible for communications outside the network.

shell The outer layer of a program, usually in the form of a graphical user interface, which is more user-friendly than the blunt command line. The shell uses menus or icons to present the options that the program provides. This avoids the need for a user to memorize the commands and options.

SIMM Single In-line Memory Module, a printed circuit board holding memory chips. SIMMs are easier to install than individual memory chips.

software Computer instructions that are executed by the microprocessor, or more generally, anything that is not hardware or data.

source In a DOS command that involves moving data from one location to another, the original location from which data is to be moved. The target location is termed the destination.

spreadsheet An array of cells containing data, arranged in rows and columns, where some of the cells' values are the result of a calculation performed on other cells. If the value in one of these cells changes, the result also changes. Using a spreadsheet application, you first define the nature of the spreadsheet (field sizes, type of contents, etc), and then enter either data or a formula to the cells. You can then print the spreadsheet, convert it to graphics like pie charts, or export it to a word processing or desktop publishing application.

subdirectory Any directory underneath any other. Every directory except the root directory is a subdirectory. The terms subdirectory and directory are used interchangeably.

SVGA Super VGA, a graphics standard that provides better resolution than VGA. Can be 800 x 600 or 1024 x 768 pixels.

swapping The technique by which a program or file that is too large to fit in memory is brought into memory as needed. When another part is needed, some other part is swapped out to disk.

synchronous A mode of communication that is regulated by clock pulse, as with the computer's internal transfers. Differs from asynchronous, the normal mode for data transmission between two computers over telephone lines.

T

Tab key (1) The key that moves the cursor to the next tab stop in a word processor. (2) Used by some applications to step from one field to another in a group of items.

tape A magnetically coated strip of plastic on which data can be recorded, as in audio tape. Access is slow and sequential, making tape an excellent medium for backing up disks and for long term storage. Tape cartridges can hold over 1 GB and are relatively cheap.

terminal A device consisting of a keyboard and monitor for access to a computer. The term usually refers to a device with no intelligence, but some terminals can have a CPU and memory.

text Data in the form of letters, numbers, and punctuation, organized into words, sentences, and paragraphs, to be formatted into lines and pages. Does not include data in tables or as part of a graphic image.

text mode see character mode

TIFF Tagged Image File Format, a very common format for bit-mapped graphics files.

tiling An arrangement of windows in a graphical user interface (GUI) in which all windows are visible, unlike the cascade arrangement in which they overlay each other.

track A circle on a magnetic disk along which data is written. Floppy disks typically have 40 or 80 tracks, and hard disks can have several hundred tracks. New disks are unformatted and must go through a formatting process to lay out the tracks. Until then, they are unusable.

TSR Terminate and Stay Resident programs that are loaded during a boot and remain in memory while other programs are executing. TSRs include calculators, calendars, and notepads. They are usually invoked by hitting a hot key, a special key sequence like Ctrl + Escape.

typeface The design of a set of characters, like Times Roman or Helvetica. The combination of typeface and type size is called a font.

U

UNIX A powerful but unfriendly operating system developed by Bell Labs for workstations used for computer-aided design. With the increasing power of personal computers, a PC version called Xenix has been developed, but it is incompatible with DOS.

V

vector graphics The term for graphics programs and images that use geometrical formuli to create images rather than an arrangement of dots, as in bit-mapping.

VGA Video Graphics Adapter, a high-resolution color graphics standard using 720 x 480 pixels, or 320 x 200 pixels, able to display 262,144 colors. It is incompatible with lower resolution video adapters because VGA uses analog signals rather than digital.

video adapter An expansion board that enables a computer to interface to a monitor. Adapters work either in text mode or graphics mode.

virus A small program passed from one computer to another on disks or through a network that interferes with the normal operation of the computer. Viruses typically replicate and consume all available memory, bringing the machine to a halt, or worse, corrupting or deleting files on the hard disk. If you exchange data with other users, an anti-virus program is a wise investment.

volume label The name of a disk volume allowing easier disk management.

W

warm boot Resetting a computer that it already turned on. Used following a system crash which leaves memory in disarray. It clears memory but does not go through the initial diagnostic self-check. (Differs from a cold boot, in which the machine is brought up from no-power.

wild card The symbols ? and * used in filenames to stand for any other character. ? refers to one character in its position only, whereas * stands for any number of characters. For example, the command COPY MYFILE?.WP would copy files with names like MYFILE0.WP through MYFILE9.WP, and MYFILEA.WP through MYFILEZ.WP. The asterisk is more powerful, and MY*.WP would involve all .WP files with MY as the first 2 characters.

Windows The operating environment developed by Microsoft for providing a consistent environment for application developers. Windows provides a graphical user interface, but is much more. It contains a memory manager, clipboard, and other internal software that enhances the way DOS operates.

.WK1 The current extension for Lotus data files (early versions used a .WKS extension). Many applications can import .WK1 files directly.

WMF Windows Metafile Format, a graphics file format used by applications running under Windows.

word processing Text-based applications used to create and edit documents. Include powerful tools to format text, move blocks of text within a document, copy, cut and paste text, search for strings of text and replace with other strings, and print. Many word processors also include features like mail merge, font selection, check spelling, number pages, document linkage, and definition of macros (predefined sequences of frequently used commands. The more advanced word processors like WordPerfect for Windows and Word for Windows include features found in desktop publishers, like graphics capability, table of contents and index generators, and WYSIWYG display.

WORM Write Once, Read Many, an optical disk technology that supports user writing once. Optical disks work by burning the surface with a laser to record, and reading by detecting the light reflected by a second laser. A worm disk can hold up to 1 GB.

write protect The technique of marking a disk so that the drive's write mechanism is disabled, much like taking the plastic tabs off an audio cassette. 5¼ inch disks are protected by placing tape over the notch on the side. 3½ inch disks are protected by sliding a plastic tab so that a hole is open.

WYSIWYG Short for "what you see is what you get," or the ability of a monitor to exactly replicate the final printed output.It involves generating fonts for the screen as well as for the printer and clear representation of graphic images. However, because monitor resolution is much less than that of laser jet printers, the monitor can only approximate the final output quality.